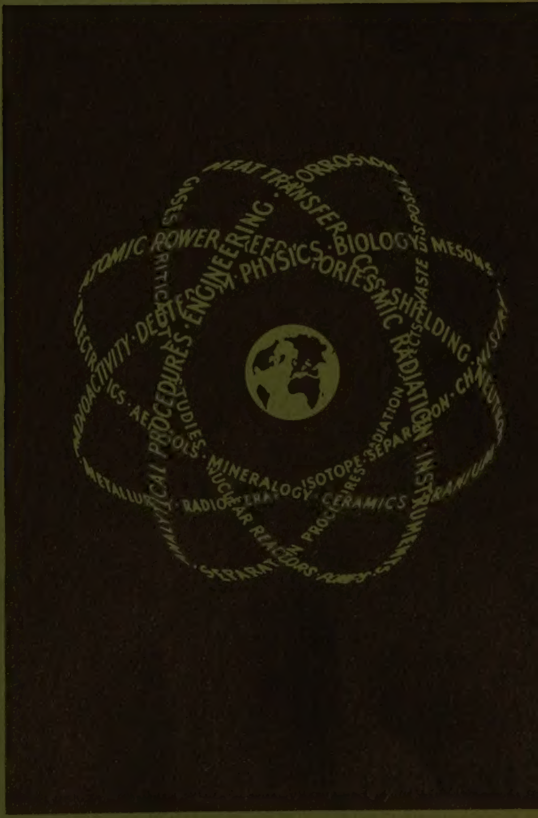
.541
4a
12A

NUCLEAR SCIENCE ABSTRACTS

UNIVERSITY OF ILLINOIS
LIBRARY
JUL 13 1960
CHICAGO



June 30, 1960

Volume 14 Number 12A
Abstracts 11373 – 12398

UNITED STATES ATOMIC ENERGY COMMISSION
Technical Information Service

USAEC DEPOSITORY LIBRARIES

Collections of USAEC reports are maintained in the libraries of the organizations listed below for reference use by the general public. Facilities for making photocopies are available. The USAEC also makes available through these libraries atomic energy reports of countries other than the U.S. that are abstracted in NSA.

ALABAMA
Auburn, Auburn University
Birmingham, Public Library

ARIZONA
Tucson, University of Arizona

ARKANSAS
Fayetteville, University of Arkansas

CALIFORNIA
Berkeley, University of California
Los Angeles, University of California
Menlo Park, Stanford Research Institute
San Diego, Public Library

COLORADO
Denver, Public Library

CONNECTICUT
New Haven, Yale University

DELAWARE
Newark, University of Delaware

DISTRICT OF COLUMBIA
Washington, Library of Congress

FLORIDA
Coral Gables, University of Miami
Gainesville, University of Florida

GEORGIA
Atlanta, Georgia Institute of Technology

HAWAII
Honolulu, University of Hawaii

ILLINOIS
Chicago, John Crerar Library
Chicago, University of Chicago
Evanston, Northwestern University
Urbana, University of Illinois

INDIANA
Indianapolis, Public Library
Lafayette, Purdue University

IOWA
Ames, Iowa State University

KANSAS
Manhattan, Kansas State University

KENTUCKY
Lexington, University of Kentucky
Louisville, University of Louisville

LOUISIANA
Baton Rouge, Louisiana State University
New Orleans, Tulane University

MARYLAND
Baltimore, Johns Hopkins University
College Park, University of Maryland

MASSACHUSETTS
Cambridge, Harvard University
Cambridge, Massachusetts Institute of Technology

MICHIGAN
Ann Arbor, University of Michigan
Detroit, Public Library

MINNESOTA
Minneapolis, University of Minnesota

MISSOURI
Kansas City, Linda Hall Library
Rolla, University of Missouri School of Mines and Metallurgy
St. Louis, Washington University

MONTANA
Bozeman, Montana State College

NEVADA
Reno, University of Nevada

NEW JERSEY
Princeton, Princeton University

NEW MEXICO
Albuquerque, University of New Mexico

NEW YORK
Buffalo, University of Buffalo
Ithaca, Cornell University
New York, Atomic Industrial Forum, Inc.
New York, Columbia University
New York, Public Library
Rochester, University of Rochester
Schenectady, Union College
Syracuse, Syracuse University
Troy, Rensselaer Polytechnic Institute

NORTH CAROLINA
Charlotte, Charlotte and Mecklenburg County Public Library
Durham, Duke University
Raleigh, North Carolina State College

OHIO
Cincinnati, University of Cincinnati
Cleveland, Public Library
Columbus, Ohio State University
Toledo, University of Toledo
Youngstown, Youngstown University

OKLAHOMA
Stillwater, Oklahoma State University

OREGON
Corvallis, Oregon State College
Portland, Reed College

PENNSYLVANIA
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University

PUERTO RICO
Rio Piedras, University of Puerto Rico

RHODE ISLAND
Providence, Brown University

SOUTH CAROLINA
Columbia, University of South Carolina

TENNESSEE
Knoxville, University of Tennessee
Memphis, Public Library
Nashville, Joint University Libraries

TEXAS
Austin, University of Texas
College Station, Agricultural and Mechanical College of Texas
Dallas, Southern Methodist University
Houston, Rice Institute
San Antonio, Public Library

UTAH
Salt Lake City, University of Utah

VIRGINIA
Blacksburg, Virginia Polytechnic Institute
Charlottesville, University of Virginia

WASHINGTON
Pullman, Washington State University
Seattle, University of Washington

WEST VIRGINIA
Morgantown, West Virginia University

WISCONSIN
Madison, University of Wisconsin
Milwaukee, Public Library

WYOMING
Laramie, University of Wyoming

NUCLEAR SCIENCE ABSTRACTS

A Semimonthly Publication of the United States Atomic Energy Commission Technical Information Service

PURPOSE AND SCOPE

Nuclear Science Abstracts (NSA) serves scientists and engineers interested in the field of atomic energy by providing abstracts of the literature on nuclear science and engineering as well as immediate and detailed indexes to that literature.

NSA covers (1) research reports of the United States Atomic Energy Commission and its contractors; (2) research reports of government agencies, universities, and industrial research organizations on a world wide basis; (3) translations, patents, books, and articles appearing in technical and scientific journals.

ARRANGEMENT OF ABSTRACTS

Abstracts are arranged according to broad subject categories as illustrated by the Contents (page iii). A new system of subject categories has been introduced in Volume 14.

INDEXES

Indexes in Individual Issues

Each issue of *NSA* includes personal and corporate author, subject, and report number indexes. Report numbers are also indicated in the author and subject indexes. The author indexes include "short" titles of the items indexed. The Report Number Index provides information on the availability of the reports.

Cumulated Indexes

The indexes included in the individual issues are cumulated quarterly, semi-annually, and annually. A cumulated report number, author, and subject index covering Vols. 1 through 4 (July 1948 – 1950) is included in the bound Vol. 4 which is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. ($6.00). A subject and author index covering Vols. 5 through 10 (1951 – 1956) is available from the Superintendent of Documents ($5.25).

A cumulated report number index to *NSA* through Vol. 13 (1959) and to its predecessor, *Abstracts of Declassified Documents*, has been issued separately as report TID-4000, 5th Ed., *Public Availability of Reports Abstracted in Nuclear Science Abstracts*. This report is available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. ($5.00).

AVAILABILITY OF *NSA*

Sale

The semimonthly abstract issues and the four cumulated-index issues of *Nuclear Science Abstracts* are available postpaid on subscription and in single copy from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at the prices indicated below:

Semimonthly issues. Annual subscription rate: $18.00, domestic; $22.50, foreign. Price per single copy: $1.25, domestic; 25 per cent extra for foreign mailing.

Cumulated-index issues. Annual subscription rate: $15.00, domestic; $17.50, foreign. Price per single copy varies according to the number of pages.

Domestic subscription rates apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.

Foreign subscription rates apply to Argentina, Brazil, British and French Guiana, Surinam, British Honduras, and all other countries throughout the world.

Exchange

NSA is also available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Technical Information Service Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Journal articles, books, and other privately published materials are not available from the AEC. Detailed information on obtaining reports and translations is given in the introduction to the Report Number Index.

U. S. Patents

Copies of U. S. patents may be ordered from the U. S. Patent Office, Department of Commerce, Washington 25, D. C. ($0.25 per copy).

United Kingdom Patents

Copies of United Kingdom patents may be ordered from The Patent Office, 25, Southampton Buildings, London W.C.2, England ($0.49 per copy).

Use of funds for printing this publication approved by the Director of the Bureau of the Budget February 3, 1959.

Y 3. At 7: 16/14-12 A

CONTENTS

Volume 14, Number 12A, June 30, 1960

Category	Abstract	Page
GENERAL AND MISCELLANEOUS	11373	1437
BIOLOGY AND MEDICINE		
General and Miscellaneous	11399	1440
Biochemistry, Nutrition, and Toxicology	11424	1444
Fallout and Radiation Ecology	11428	1444
Radiation Effects on Living Tissues	11435	1445
Radiation Sickness	11482	1452
CHEMISTRY		
General and Miscellaneous	11483	1452
Analytical Procedures	11587	1465
Radiation Chemistry	11644	1471
Radiochemistry	11659	1473
Raw Materials and Feed Materials	11664	1474
Separation Processes	11678	1476
ENGINEERING AND EQUIPMENT		
General and Miscellaneous	11699	1478
Heat Transfer and Fluid Flow	11716	1480
Instrumentation	11731	1482
Materials Testing	11774	1487
GEOLOGY, MINERALOGY, AND METEOROLOGY	11780	1487
HEALTH AND SAFETY INCLUDING DOSIMETRY	11825	1493
ISOTOPE SEPARATION	11874	1501
MATHEMATICS AND COMPUTERS	11885	1502

Category	Abstract	Page
METALS, CERAMICS, AND MATERIALS		
General and Miscellaneous	11888	1502
Corrosion	11921	1507
Fabrication	11941	1509
Properties and Structure	11962	1512
Radiation Effects	12034	1522
PHYSICS		
General and Miscellaneous	12067	1525
Astrophysics and Cosmology	12126	1533
Cosmic Radiation	12127	1533
Criticality Studies	12135	1534
Elementary Particles	12136	1534
Nuclear Properties and Reactions	12201	1542
Particle Accelerators	12262	1550
Plasma Physics and Thermonuclear Processes	12279	1552
Shielding Calculations	12317	1557
Theoretical Physics	12320	1557
REACTOR TECHNOLOGY		
General and Miscellaneous	12323	1558
Power Reactors	12347	1560
Research Reactors	12377	1564
WASTE DISPOSAL AND PROCESSING	12392	1566
CORPORATE AUTHOR INDEX		INDEX-1
PERSONAL AUTHOR INDEX		INDEX-9
REPORT NUMBER INDEX		INDEX-39
SUBJECT INDEX		INDEX-47

Legal Notice

The AEC reports listed in this document are accounts of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in these reports, or that the use of any information, apparatus, method, or process disclosed in these reports may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in these reports.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

NUCLEAR SCIENCE ABSTRACTS

Volume 14 Number 12A June 30, 1960

GENERAL AND MISCELLANEOUS

11373 NBS-D-119
National Bureau of Standards, Washington, D. C.
NATIONAL BUREAU OF STANDARDS QUARTERLY PROGRESS REPORT TO THE UNITED STATES ATOMIC ENERGY COMMISSION FOR JULY, AUGUST, AND SEPTEMBER 1952. Jan. 1953. Decl. Mar. 2, 1960. 50p. OTS.

Changes in design specifications of high-potential batteries of the Zamboni type are given. Betatron x-ray-attenuation studies show a maximum of the order of 10^5 at 20, 30, and 38 Mev, and 10^4 at 6 and 10 Mev, using concrete slab thicknesses from 54 to 96 in. Beryllium borohydride was prepared from a dry mixture of lithium borohydride and beryllium chloride. A method for synthesis of perylene is given. Phase studies were made of silver-uranium alloys. Chemical and x-ray studies were made of preparations in the binary system $UC-UC_2$ and the ternary system $UC-UC_2-Be_2C$, after heating at 1700°C to determine the identity and composition of the stable phases under these conditions. (L.M.T.)

11374 NBS-D-121
National Bureau of Standards, Washington, D. C.
QUARTERLY PROGRESS REPORTS TO THE UNITED STATES ATOMIC ENERGY COMMISSION FOR OCTOBER, NOVEMBER, AND DECEMBER 1952. Decl. Mar. 2, 1960. 49p. OTS.

Shelf-life performances of various dry batteries are summarized. Infrared absorption measurements on H_2O, HDO, and D_2O are reported. The apparatus discussed in the preceding report for the preparation of Be bromide was redesigned to allow for direct contact between the Be and Br. No reaction between Be and I was observed at temperatures up to 300°C, but complete reaction was observed at 480°C. An attempt was made to prepare mixed tetraaryl silanes by reacting diphenyl dichlorosilane or triphenyl chlorosilane with the Grignard reagent or Li compound of aryl halide. Phase studies are reported on the systems U-Ag and U-Au. Constitution diagrams are presented for the systems U-C and $UC-Be_2C$. (For preceding period see NBS-D-119.) (L.T.W.)

11375 NP-8448
Naval Research Lab., Washington, D. C.
NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period October-November 1959. Jan. 1, 1960. 78p.

Nuclear Constituents and Structure. A compact low-field gaussmeter and its calibration are described. A $Mg^{24}O$ target was bombarded by 5.52-Mev He^3 particles and proton recoils measured at 0 and 135° to give M-A values for Ne^{18} and Si^{26} of 10.65 ± 0.05 Mev and 0.47 ± 0.09 Mev. A precision determination was made of the $C^{12}(He^3,n)$ threshold. Energy levels in Ne^{20} from the $F^{19}(d,n\gamma)$ reaction were studied. The positron decay of Ne^{18} was studied to check the T = 1 assignment of the 7.08-Mev state in F^{18}. Parallelism between baryon doublets and neutrino doublets was explored. Previous calculations of the vacuum polarization effect are indicated and it is shown that the Wightman theory can be used to obtain the same result. Nuclear Instrumentation and Technology. An experiment is described which investigates the rise-time characteristics and the limitations imposed on the rise time by tube and circuit parameters in the use of hydrogen thyratrons for mμ-sec switching operations. Nuclear Power. A preliminary report is given on the albedo results obtained for 2.50- and 6.13-Mev photons incident normally on Fe and for 6.13-Mev photons on Fe at 0, 22, 44, 66, and 88°. Nuclear Weapons. A Co^{60} source for radiation chemistry research is described. A solvent extraction method for separation of carrier-free Re from irradiated Os is briefly described. A mathematical treatment is given on the effect of initial molecular weight distribution on average molecular weight for polymers undergoing cross-linking and chain scission. Corrosion. A study is reported of the effect of boiler-water additions on the corrosion rate of mild steel. (For preceding period see NP-8086.) (T.R.H.)

11376 NP-8481
Joint Establishment for Nuclear Energy Research, Kjeller, Norway.
EIGHTH ANNUAL REPORT, JULY 1958-JUNE 1959 OF THE NETHERLANDS'-NORWEGIAN JOINT ESTABLISHMENT FOR NUCLEAR ENERGY RESEARCH. 32p.

Brief summaries of the main activities of JENER for the year 1958-59 are given in the areas of isotopes, chemistry, metallurgy, reactor engineering, physics, health physics, and administrative work. (For Seventh Annual Report see Np-7579.) (W.D.M.)

11377 NP-8497
California Inst. of Tech., Pasadena. Jet Propulsion Lab.
RESEARCH SUMMARY NO. 36-1, VOLUME I, FOR THE PERIOD DECEMBER 1, 1959 TO FEBRUARY 1, 1960. Feb. 15, 1960. 121p. Contract NASw-6.

A report of supporting research and development activities at JPL is presented. Activities at the Deep Space Instrumentation Facility are reported including receiver and transmitter development and research in advanced communication techniques. Space navigation studies included those on space vehicle attitude sensing, thermal guidance, trajectories, and orbit estimation. Progress is reported in research on communication systems components and methods of electronic equipment cooling. Research in guidance and control included work on gas bearings, accelerometers, and antenna range design. Materials research was conducted on graphite whiskers, high melting metals, pyrolytic graphite, endothermal materials, pressure vessel materials, and behavior of materials in space environments. Development is reported in combustion injectors for fluid propellants, thrust chambers, and fluid mechanics. Gas dynamics research work included that on thermopile heat transfer cages and heat loss calibration of hot wires. Physics research is reported toward development of a formal solution of Liouville's equation. Other work was concerned with calculations of electron distribution and kinetic temperature in magnetic fields, and modulation broadening of Lorentzian line shapes. (J.R.D.)

11378 NP-8504
Forschungsgruppe für Entwicklungsfragen der Atomkernenergie, Heidelberg.
[BIBLIOGRAPHY ON SOCIOLOGICAL PUBLICATIONS CONCERNING THE PROBLEMS OF ATOMIC ENERGY]. [1959]. 23p.

Introduction in German; references in English, French, and German.

A bibliography of about 260 references to books, U. S. and foreign reports, periodicals, and Second Geneva Conference papers is presented. (T.R.H.)

11379 NP-8518
European Nuclear Energy Agency, Paris.
SECOND REPORT ON THE ACTIVITIES OF THE AGENCY, PRESENTED TO THE CONSULTATIVE ASSEMBLY OF THE COUNCIL OF EUROPE. Jan. 1960. 152p.

Joint undertakings, scientific co-operation, regulation and control, and economic questions are discussed in detail. Reports and decisions relating to the activities of ENEA are appended. Estimates of nuclear energy production and programs of the OEEC countries are summarized. (W.D.M.)

11380 R-348(RAND)
RAND Corp., Santa Monica, Calif.
A METHOD OF CONCEALING UNDERGROUND NUCLEAR EXPLOSIONS. A. L. Latter, R. E. LeLevier, E. A. Martinelli, and W. G. McMillan. Mar. 30, 1959. Decl. Oct. 20, 1959. 17p.

It is shown theoretically that nuclear explosions can be effectively hidden in large underground cavities. An estimate of the effectiveness of the method indicates that a yield of more than 300 KT could be made to look seismically like a yield of 1 KT. Experiments with both chemical and nuclear explosions are needed to test the theory. (auth)

11381 UCRL-5677
California. Univ., Livermore. Lawrence Radiation Lab. and San Francisco Operations Office, AEC.
PROCEEDINGS OF THE SECOND PLOWSHARE SYMPOSIUM, MAY 13-15, 1959, SAN FRANCISCO, CALIFORNIA. PART III. THE RECOVERY OF POWER AND ISOTOPES FROM CONTAINED UNDERGROUND NUCLEAR EXPLOSIONS. Plowshare Series: Report No. 2. May 14, 1959. 88p. Contract W-7405-eng-48. OTS.

The Second Plowshare Symposium was held on May 13 through 15, 1959, in San Francisco, California. Part III was devoted to discussions on the feasibility of the recovery of power and isotopes from contained underground nuclear explosions. Separate abstracts were prepared on eight papers presented at this symposium. (C.H.)

11382 UCRL-5677(p.4-12)
California. Univ., Livermore. Lawrence Radiation Lab.
PROJECT GNOME. Charles E. Violet. 9p.

A review is presented of preliminary studies for Project Gnome. The purpose of this project is to obtain the necessary data from a nuclear detonation in a subsurface salt formation which will provide a basis for an evaluation of the feasibility of power and isotope recovery from underground nuclear explosions. General nuclear explosion phenomenology will also be investigated. (C.H.)

11383 UCRL-5677(p.13-23)
California. Univ., Livermore. Lawrence Radiation Lab.
POWER RECOVERY CONSIDERATIONS. James F. Tracy. 11p.

Physical phenomena associated with the deposition and recovery of energy from underground nuclear detonations are discussed. Project Gnome, a proposed nuclear explosive experiment in a salt bed, is used as an example. Topics discussed include the deposition and storage of nuclear explosive energy, energy extraction, and energy recharge. (C.H.)

11384 UCRL-5677(p.24-32)
California. Univ., Livermore. Lawrence Radiation Lab.
RECOVERY OF ISOTOPES. Marcel W. Nathans. 9p.

Problems to be considered in the recovery of radioisotopes following an underground nuclear explosion in a salt bed include the preparation of the site, the mounting of the neutron source and an appropriate blanket, the detonation, the recovery of ore from the ground, and the processing of ore and final purification of the isotopes. Calculations on the cooling of a molten sphere of salt in an infinite extent of solid salt are included. Results are reported from a tracer experiment and problems requiring further research are outlined. (C.H.)

11385 UCRL-5677(p.33-44)
Oak Ridge National Lab., Tenn.
THERMODYNAMIC PREDICTION OF CHEMICAL SPECIES RESULTING FROM NUCLEAR EXPLOSIONS CONTAINED IN BEDDED SALT MEDIA. W. D. Bond and W. E. Clark. 12p.

Thermodynamic estimates are presented of the nature and stability of some chemical states of hydrogen which can coexist in equilibrium with rock salt. Salt from the beds of the Salado formation was chosen for the experiments reported since it is expected to be the containment medium for the Gnome event. The results of these calculations are used to predict the stable species that will result from other elements whose reactivities relative to hydrogen are known. The magnitude and nature of chemical problems associated with the recovery of these isotopes are discussed. (C.H.)

11386 UCRL-5677(p.45-50)
Westinghouse Electric Corp. Research Labs., Pittsburgh.
TECHNICAL PROBLEMS INVOLVED IN THE EXTRACTION OF ELECTRICAL POWER FROM NUCLEAR EXPLOSIVES USING PREFORMED CAVERNS. Clarence Zener. 6p.

Factors affecting the commercial feasibility of extracting electrical power from nuclear explosives are discussed. The effectiveness of hydrogen in distributing the heat of a nuclear explosive is considered. The general features that a nuclear explosive is expected to manifest in hydrogen gas are reviewed. An equation is included which shows that the fireball will not be reduced below 100,000°K before the formation of a shock wave. Shock waves must therefore be relied upon for further homogenization of temperature. The significance of the analysis with respect to the feasibility of commercial thermonuclear power plants is discussed. (C.H.)

11387 UCRL-5677(p.51-7)
Humble Oil and Refining Co., Houston, Tex.
USE OF PROMPT NUCLEAR DEVICES FOR THE RECOVERY OF THERMAL ENERGY. H. G. Corneil and A. D. Suttle, Jr. 7p.

A study was made of the feasibility of operating prompt nuclear devices in salt domes as a source of large quantities of energy which may be used to produce process heat for chemical reactions or electric power by a water-steam cycle. Salt domes were selected as the operating medium because they are large, isolated, compact, competent formations whose properties are well established and whose geology and geophysics have been thoroughly studied. The physical and chemical properties of the sodium chloride in these structures makes them well suited to this use. Overburden requirements, cavity size, the phenomenology of 10-megaton operation, and economic considerations are considered. On the basis of the economic and scientific information available, it was concluded that it will be necessary to use devices of at least one megaton and probably ten megatons yield to generate competitive thermal energy. When operating with the most favorable conditions there is a reasonable chance that an adequate roof structure can be maintained to permit an economic and workable operation. There are no fundamental limitations which preclude the proposed operation or which render it prohibitively expensive. (C.H.)

11388 UCRL-5677(p.58-77)
Los Alamos Scientific Lab., N. Mex.
CONTAINMENT OF CHEMICAL EXPLOSIONS. Bob E. Watt. 20p.

Results are reported from experiments to estimate the characteristics of a vessel which would contain a nuclear explosion. The basic system tested consisted of a vessel filled to varying degrees with ordinary table salt to degrade the shock wave. The duration of the pressure pulse was comparable to or less than the resonant period of the vessel. Integration of the pressure over time gave the momentum delivered to the wall, which oscillates according to the resonant characteristics of the vessel. Maximum displacement was proportional to the momentum. The pressure-volume curves for static and dynamic loading of table salt are data on the shock and particle velocities vs. pressure; equations of motion for the vessel, pipe data, spherical data, and experimental data are included. (C.H.)

11389 UCRL-5677(p.78-87)
Sandia Corp., Albuquerque, N. Mex.
UTILIZING NUCLEAR EXPLOSIVES IN THE CONSTRUCTION OF GEOTHERMAL POWER PLANTS. Roland H. Carlson. 10p.

Applications of nuclear explosives in harnessing geothermal activity are considered. In all cases of geothermal steam the heat source is believed to be thousands of feet below the surface. The heat moves to the surface through cracks, fissures, and faults in the form of super heated steam. It appears that these sources are for all practical purposes inexhaustible. Geothermal power plants have proved both economical and dependable. Applications of nuclear explosions for the construction of geothermal power plants are considered. The availability of ground water for steam production and the creation of underground steam cavities are discussed. Sketches are included of a conventional geothermal and power plant and a similar plant constructed with nuclear explosives. A cavity created by nuclear explosives would significantly decrease the number of wells required and negate the probability of drilling either a nonproducing well or a low-capacity well. Problems of containment, placement, radiation, and cost factors are discussed. (C.H.)

11390 UCRL-5679
California. Univ., Livermore. Lawrence Radiation Lab. and San Francisco Operations Office, AEC.
PROCEEDINGS OF THE SECOND PLOWSHARE SYMPOSIUM, MAY 13-15, 1959, SAN FRANCISCO, CALIFORNIA. PART V. SCIENTIFIC APPLICATIONS OF NUCLEAR EXPLOSIVES IN THE FIELDS OF NUCLEAR PHYSICS, SEISMOLOGY, METEOROLOGY, SPACE. (Cover Carries Part V title as: SCIENTIFIC USES OF NUCLEAR EXPLOSIONS). Plowshare Series. Report No. 2. May 15, 1959. 111p. Contract W-7405-eng-48. OTS.

The Second Plowshare Symposium was held in San Francisco, California, on May 13 to 15, 1959. Scientific applications of nuclear explosives in the fields of nuclear physics, seismology, meteorology, and space were discussed. Separate abstracts have been prepared on 11 papers presented at this symposium. (C.H.)

11391 UCRL-5679(p.4-12)
Los Alamos Scientific Lab., N. Mex.
NUCLEAR EXPLOSIONS AS NEUTRON SOURCES. George A. Cowan. 9p. OTS.

Information contained in this paper issued separately as LAMS-2391.

Fission explosions produce about 2×10^{23} neutrons per kiloton of fission energy. Thermonuclear devices produce about 2×10^{24} neutrons per kiloton of energy. Applications of the neutrons produced by nuclear explosions as an energy source for scientific experiments are discussed. Results are reported from three such experiments. These include the discovery of the new elements einsteinium and fermium in the debris of the first large-scale thermonuclear explosion; the use of the sharply pulsed neutron burst from a small nuclear explosion to bombard uranium-235 with neutrons which were energy-resolved by time-of-flight techniques; and a world-wide tracer experiment in which rhodium-102, with a 220-day half life, was produced during a high-altitude explosion in large enough quantity to permit its identification as fall-out in small air samples collected at the earth's surface. Applications in studies of the rate of mixing of the upper stratosphere with the lower stratosphere are discussed. Other ways are suggested in which nuclear explosions may be utilized to increase scientific knowledge. (C.H.)

11392 JPRS-3116
TRANSLATIONS FROM K'O-HSUEH HSIN-WEN (SCIENCE NEWS), No. 30, September 28, 1959. Peiping. 27p. OTS.

The progress made by communist China since 1949 in the fields of nuclear physics, electronics, and mathematics is discussed. (C.J.G.)

11393

PRODUCTION AND APPLICATIONS OF STABLE ISOTOPES IN USSR. S. P. Potapov. Atomnaya Energ. 8, 160-4(1960) Feb. (In Russian)

A review is given of isotope production and applications of the growth of the isotopic industry. Production of hydrogen and uranium isotopes is not included. (R.V.J.)

11394

THE TWO KILOCURIE COBALT-60 GAMMA-RAY IRRADIATION FACILITY. Sunao Okamoto and Yasuyuki Nakayama (Kyoto Univ.) and Kunihito Takahashi (Kobe Kogyo Corp., Japan). Bull. Inst. Chem. Research, Kyoto Univ. 37, 299-305(1959) Dec.

The 2000-c Co^{60} facility installed at the Institute for Chemical Research of Kyoto University in 1958 is described. A unique mechanism for charging the source and a mechanical conveyor system for loading materials to be irradiated were designed. Some features of the facility are explained. (auth)

11395

SMALL COBALT-60 IRRADIATOR—GAMMA DOSE DISTRIBUTION IN ITS WORKING CHAMBER. Megumi Tashiro, Sumio Sakka, and Naohiro Soga (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 335-40 (1959) Dec.

An irradiator containing about 10 curies cobalt-60 designed and constructed for use in studies of radiation effects in glasses and crystals is described. The dose rate distribution in its working chamber (80 mm in dia. × 110 mm in height) determined by the use of the glass dosimeter is given. (auth)

11396

United States. Congress. Joint Committee on Atomic Energy.

AGREEMENT FOR COOPERATION BETWEEN THE UNITED STATES AND THE INTERNATIONAL ATOMIC ENERGY AGENCY. HEARING BEFORE THE SUBCOMMITTEE ON AGREEMENTS FOR COOPERATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION, JUNE 30, 1959. 94p. GPO.

Operational activities, relationships with other organizations, and administrative and budgetary matters of the U. S. Atomic Energy Commission for 1959 are presented. (C.J.G.)

11397

Atomic Energy Commission, Washington, D. C.

ATOMIC INDUSTRIAL PROGRESS AND SECOND WORLD CONFERENCE, JULY—DECEMBER 1958. Twenty-fifth Semiannual Report. 390p. $1.25(GPO).

The twenty-fifth semiannual report of AEC to the Congress is presented in three parts. Part One is a summary of industrial atomic progress during 1958, with chapters on growth of atomic industry, progress in power reactor technology, programs supporting industrial growth, radioisotope progress and development, international industrial progress, and biomedical assistance to atomic industry. Part Two, a description of United States Participation in the Second World Conference on Peaceful Uses of Atomic Energy, has chapters on highlights of the conference, general sessions on broad aspects of atomic energy development, scientific sessions of conference, and scientific and technical exhibition. Part Three is a review of major activities in selected atomic energy programs, July-December 1958. Appendixes providing data and detail on the various programs are given including abstracts of scientific and technical papers presented by U. S. delegates to the Second Geneva Conference. (T.R.H.)

11398

Atomic Energy Commission, Washington, D. C.

MAJOR ACTIVITIES IN THE ATOMIC ENERGY PROGRAMS, JANUARY—DECEMBER 1959. Annual Report. 636p. $2.00(GPO).

The AEC's annual report to Congress for 1959 is presented in three parts. Part one, The Atomic Energy Industry in 1959 and Related Activities, surveys industry and commission activities and progress in power reactor technology. Part two summarizes major activities in raw materials, special nuclear materials, military applications, programs supporting industrial growth, civil uses of nuclear explosives, international activities, isotopes, legal matters, information, training, research, nuclear materials management, construction and supply, community activities, personnel, and industrial relations. Part three discusses radioactive waste disposal, with sections on sources and problems, management, research, environmental research, licensing, regulation, and inspection. Appendices are included providing data and detail on various programs. (T.R.H.)

BIOLOGY AND MEDICINE

General and Miscellaneous

11399 AD-215768

Swift and Co. Research Labs., Chicago.

THE EFFECT OF SUB-STERILIZING DOSES OF CATHODE RAYS AND GAMMA RAYS ON THE KEEPING QUALITIES OF PORK. Report No. 8 (Progress) [for] Period August 16, 1958—November 15, 1958. W. M. Urbain. 5p. Project No. 7-84-01-002. Contract QMR and D (Natick) No. 2.

A comparison has been made wherein three different sources of radiation were used on beef steaks and pork chops at levels of 25,000 and 100,000 rads. These sources were gamma radiation from spent fuel elements, 8,000,000 volt electrons from a linear accelerator, and 800,000 volt electrons from resonant transformer. The samples were placed in polyethylene bags prior to irradiation and tested initially and after storage at 45°F for flavor, tenderness, and bacterial population. No major differences in flavor or tenderness were noted between controlled and samples irradiated under any of the above conditions. After one week at 45°F, all of the beef samples including the control had a sour taste, indicating that the irradiation did not sufficiently protect these products. The pork samples held up somewhat longer than did the beef; however, the control held up about as well as the irradiated samples. Samples of beef steaks and pork chops were also prepared in vacuum packages and treated at a level of 5,000,000 rads by gamma radiation and by the linear accelerator. Those tests are continuing and will be reported later. (auth)

11400 AD-216888

Reliable Packing Co., Chicago.

EFFECT OF IRRADIATION ON CANNED PORK PRODUCTS. Report No. 4 (Progress) [for] November 1, 1958—January 31, 1959. John E. Thompson. 5p. Project No. 7-84-01-002. Contract QMR and E (Natick) No. 50.

The purpose of these experiments is to determine the effect of irradiation on smoked meat products. Two bacon bellies, one smoked for normal time, the other double smoked, were sliced, canned and irradiated. Irradiation dosage was 4.5×10^6 rad. Triangle test organoleptic evaluation showed a significant flavor difference between the smoke treatments. No undesirable flavor was found. Further post-irradiation storage tests are presently in course. (auth)

11401 AD-229147

New York. Agricultural Experiment Station, Geneva.

A STUDY OF THE RADIATION-INDUCED SOFTENING OF PLANT TISSUES. Report No. 5 (Progress) [for] Period February 1, 1959—March 31, 1959. Z. I. Kertesz. Project No. 7-84-01-002. Contract DA-19-129-QM-1164.

Observations are summarized on holding tests on irradiated leaf lettuce. Progress is reported in respiratory measurements or lettuce leaves exposed to a wide range of gamma doses. (C.H.)

11402 AD-229213

Department of Agriculture. Plant Disease Lab., Chicago. CONTROL OF POST HARVEST DISEASES OF FRUITS AND VEGETABLES BY RADIATION TREATMENTS. Report No. 6 (Progress) [for] Period February 1, 1959—March 31, 1959. Louis Beraha and G. B. Ramsey. 8p. Project No. 7-84-01-002.

Data are summarized from experiments on the influence of a fast rate of gamma flux as opposed to a slow flux in reducing the rate and amount of decay in oranges caused by blue mold rot. (C.H.)

11403 AMRNL-235

Army Medical Research and Nutrition Lab., Denver. THE METABOLIZABLE ENERGY AND APPARENT DIGESTIBILITY OF FOOD STERILIZED BY IONIZING RADIATION. Lester M. Levy, Lionel M. Bernstein, Eugene Francis, Richard S. Harding, Harry Krzywicki, Virginia E. McGary, Jean Nuss, Jacqueline H. Sellars, and Elaine Devor. Aug. 6, 1959. 47p. Project No. 6-60-11-020.

Some 42 different irradiated foods were fed to 16 volunteer human subjects in three complete metabolic balance studies wherein the total calories from the irradiated foods or their control items were increased from 35 to 60% and to 80% in successive studies. These foods, except potatoes, were frozen, subjected to gamma radiation dosages, varying according to item, of 1 × 10^4 to 1 × 10^6 rep, and kept frozen until used. In two studies, the irradiated and control items were from the same batch; in the third, the irradiated foods were matched with similar control items. Each study was divided into two 15-day periods, consisting of three days prefeeding and two 6-day balance periods. Half the subjects were fed the irradiated menus for the first period and then changed with the control group in the last period. Proximate analyses and calorimetry were determined for all foods and excreta. Consumption of food and collection of specimens were complete. There was no significant difference between the irradiated and control foods in terms of gross energy, metabolizable energy, or macronutrients content. Coefficients of availability and nitrogen balances were essentially equal for both diets. In comparison with direct calorimetry, the gross energy and metabolizable energy of the diets tended to be over-estimated by food tables, and by application of either general or specific factors to the chemical analysis of food as determined in these studies. (auth)

11404 NP-8439

Utah State Univ., Logan. STUDIES ON RADIATION PRESERVATION OF FRUIT AND VEGETABLE PRODUCTS. Report No. 10 (Final) [for Period] December 1, 1956—November 30, 1958. D. K. Salunkhe. 122p. Project No. 7-84-01-002. Contract DA-19-129-QM-821.

Progress is reported in studies on the effects of radiation dose and rate on the flavor, microbiological contamination, shelf life, and physio-chemical changes in fruits and vegetables. (C.H.)

11405 NP-8440

Indiana. Agricultural Experiment Station, Lafayette. THE FEASIBILITY OF UTILIZING IONIZING RADIATION TO INCREASE THE STORAGE LIFE OF POTATOES. Report No. 11 (Final) [for] Period November 1, 1956—April 30, 1959. N. K. Ellis. 79p. Project No. 7-84-01-002. Contract DA-19-129-QM-789.

Results are reported from a series of studies on the effects of 5 dosages of gamma irradiation and various curing treatments on the storage life of 4 varieties of potatoes. Maximum storage period was two years. Data are tabulated and results are discussed. (C.H.)

11406 NP-8441

Massachusetts. Univ., Amherst. ENZYMOLOGY OF FRUITS AND VEGETABLES SUBJECTED TO PASTEURIZING AND STERILIZING LEVELS OF IONIZING RADIATIONS. Report No. 11 (Final) [for] Period December 12, 1956—November 30, 1958. William B. Esselen. 79p. Project No. 7-84-01-002. Contract DA-19-129-QM-815.

Progress is reported in studies of peroxidase and catalase activity in peas, green beans, carrots, and broccoli following various levels and combinations of blanching and radiation treatment. (C.H.)

11407 UCRL-9108

California. Univ., Berkeley. Lawrence Radiation Lab. BIOLOGICAL MIXTURES, SOME BIOPHYSICAL PROBLEMS, AND THE STABLE-FLOW FREE-BOUNDARY METHOD. Howard C. Mel. Feb. 26, 1960. 36p. Contract W-7405-eng-48. OTS.

New apparatus and methods are described for use in biophysical and biochemical research. Applications are discussed in studies on weak interactions between biological substances; experiments with cell suspension; experiments with labile biological activities; the handling of dilute samples in large volumes; good-resolution separation; controlled reaction studies; and analytical measurements of transport properties. Several new approaches are suggested to old problems in electrophoretic separation, the rapid mixing and unmixing of chemical or biological reactants, and the instantaneous measurement of transport properties which depend on time in an explicit manner. Some typical examples are presented of the initial experimental results in these areas with small molecules, large molecules, and cells. (C.H.)

11408 UMRI-2307-12-P

Michigan. Univ., Ann Arbor. School of Public Health, Michigan. Univ., Ann Arbor. Fission Products Lab., and Michigan. Univ., Ann Arbor. Medical School. AN INVESTIGATION OF ARTERIAL LESIONS IN RATS FED DIETS CONTAINING WHOLE POTATOES. Progress Report No. 12. C. H. Burns, G. D. Abrams, and L. E. Brownell. Nov. 1959. 12p. Project 2307. Contract DA-49-007-MD-581.

Results are reported in an investigation of vascular lesions occurring in rats serving as subjects in studies on the wholesomeness of irradiated potatoes. Both a genetic factor and a dietary factor were found to be involved. Data are tabulated on the condition in the third, fourth, and fifth generations of rats maintained on diets containing irradiated potatoes. (C.H.)

11409 UMRI-2681-10-P

Michigan. Univ., Ann Arbor. Research Inst. DETERMINATION OF RADIATION STERILIZATION DOSE FOR CANNED MEAT. Report No. 10 (Progress) [for] February 1, 1959 to April 30, 1959. L. L. Kempe. 9p. Project No. 7-84-01-002. Contract DA-19-129-qm-964. (AD-229217).

Unswollen cans of meat, taken from the inoculated packs of irradiation-processed meat under incubation, have been found to contain type A botulinus toxin. The cans of meat containing this toxin had been inoculated with approximately 10^8 *C. botulinum* 62A spores per can before irradiation processing. This suggests an upper limit for *C. botulinum* spore inocula where toxin presence is to be used as a criterion of irradiation sterilization. Further study of this finding is suggested. Studies have been initiated to evaluate the effect of temperature and of gamma radiation field strength during irradiation on survivor curves of anaerobic bacterial spores. (auth)

11410 UR-564
Rochester, N. Y. Univ. Atomic Energy Project.
COMPARATIVE EFFECTS OF GLUCAGON, HYDROCORTISONE AND EPINEPHRINE ON THE PROTEIN METABOLISM OF THE FASTING RAT. Joseph L. Izzo, Stanley R. Glasser, and S. Lee Crump. May 30, 1958. 26p. Contract W-7401-eng-49. OTS.

An approach toward the elucidation of the mechanism of glucagon in promoting protein catabolism has been made by comparing the effects of glucagon and hydrocortisone using female rats fasted five days. The possible relationship of the level of liver glycogen to protein catabolism has also been investigated by comparing the action of glucagon and epinephrine. Both glucagon and hydrocortisone-treated animals lost more weight and excreted more urinary nitrogen, phosphorus, and creatinine than controls. The rate of excretion of glucagon-treated rats declined progressively whereas that of hydrocortisone-treated rats increased progressively throughout the course of the experiment. Although the animals in both groups lost similar amounts of urinary nitrogen the glucagon-treated rats lost less body weight, tissue protein and urinary phosphorus. Furthermore, hydrocortisone caused an elevation in the level of blood α-amino nitrogen whereas glucagon caused blood α-amino nitrogen to be depressed. These results suggest that glucagon and hydrocortisone cause protein catabolism by different mechanisms. It is proposed that glucagon acts directly on the liver to facilitate the catabolism of amino acids in contrast to the postulated action of hydrocortisone in mobilizing amino acids from extrahepatic tissues. Epinephrine and glucagon depressed liver glycogen but the glycogenolytic effect of epinephrine was of borderline significance. However, epinephrine-treated rats did not differ from controls in respect to any of the above mentioned parameters of protein metabolism. This suggests that the protein catabolic action of glucagon is not directly a consequence of reduced hepatic glycogen. (auth)

11411
CONTINUOUS MEASUREMENT OF SPECIFIC ACTIVITY OF $C^{14}O_2$ IN EXPIRED AIR. George V. LeRoy, George T. Okita, Edward C. Tocus, and Donald Charleston (Univ. of Chicago). Intern. J. Appl. Radiation and Isotopes 7, 273-86(1960) Feb. (In English)

The majority of carbon compounds of metabolic interest ultimately are degraded to carbon dioxide and urea which are excreted. Following the administration of a tracer dose of a C^{14}-labeled metabolite, there is assumed to be a pattern of elimination of $C^{14}O_2$ which is characteristic for the healthy state, and which is distorted in disease. This pattern is represented by the time-course of specific activity of $C^{14}O_2$ in expired air. Metabolic studies in human subjects and in animals are facilitated by the apparatus described in this report which permits the continuous measurement of radioactive $C^{14}O_2$ in expired air. The apparatus consists of an air-collection system, a ventilation meter, a $C^{12}O_2$ (infrared) analyzer, a 4π G-M counter with anti-coincidence circuitry, and a ratio analyzer to compute C^{14}/C^{12}. Analog data are printed out on a four-channel recording millivoltmeter at the rate of four items per minute on each channel. The data are in such a form that they can be converted readily to digital information for processing in a high-speed computer. Rapid estimates of the size and kinetics of the carbon dioxide pool are possible when labeled bicarbonate is used as the tracer. (auth)

11412
QUENCHING EFFECTS AND THE AFTERGLOW OF CHLOROPHYLL. H. O. Albrecht (Bartol Research Foundation, Swarthmore, Penna.), W. C. Denison and L. G. Livingston (Swarthmore Coll., Penna.), and C. E. Mandeville (Univ. of Alabama, Tuscaloosa). J. Franklin Inst. 268, 278-82(1959) Oct.

The weak light-emission of Chlorella pyrenoidosa about 4 seconds after illumination by photosynthesizing blue light shows an apparent partial quenching when radiation at λ7000 A is simultaneously applied. This result accords with the present view that this afterglow arises from the thermal release of electrons trapped in a crystalline structure of chlorophyll. The "quenching" radiation would provide optical release. Phosphorescence excited by longer wavelengths than blue is not quenched, suggesting it to arise by an essentially different mechanism. Chlorophylls and derivatives dissolved in a film of cellulose butyrate show a rather characteristic weak afterglow, often of several minutes half-life, of shorter wave-length than the fluorescence, and which is not certainly a light-induced oxidative chemiluminescence. (auth)

11413
REDUCTION OF THE RADIOACTIVE CONTENT OF MILK BY A FEEDING PROCEDURE. Robert H. Fetner and Randall W. Carter (Georgia Inst. of Tech., Atlanta). Nature 185, 858(1960) Mar. 19.

Preliminary results are reported from an investigation of a method for reducing the fall-out content of milk. Cattle on dry lot were fed the product of commercially available grass incubators which hydroponically germinate various grains to be used as a substitute for fresh pasturage. Cows in an experimental group fed 20 pounds of incubator feed daily in addition to their usual hay and grain diet gave milk with an average of 38% less cesium-137 than that from cows on green pasturage. (C.H.)

11414
COMPARATIVE PASSAGE OF Sr^{85} AND Ca^{45} FROM PLASMA INTO BODY FLUIDS IN MAN. Joseph Samachson, Bernard Kabakow, and Herta Spencer (Montefiore Hospital, New York). Proc. Soc. Exptl. Biol. Med. 103, 570-4 (1960) Mar.

The passage of strontium and calcium from plasma into peritoneal, pleural, and interstitial fluids has been studied in man following intravenous injection of Sr^{85} and Ca^{45}. Rates of passage of the 2 isotopes into peritoneal cavity have been calculated. In 1 case, Ca^{45} entered the cavity more rapidly than Sr^{85}, in another, Sr^{85} entered more rapidly, and in 2 cases, both radioisotopes entered at the same rate. Both ions passed more rapidly into and out of the peritoneal cavity than the fluid accumulated, but passage of ions was slower than flow of water. Rate of passage varied in different patients as did ratio of rates for Sr^{85} and Ca^{45}. The high protein content indicated that peritoneal fluid was not an ultrafiltrate although the Sr^{85}/Ca^{45} ratio corresponded to that of an ultrafiltrate in some cases. The ratio in pleural fluid approximated that of an ultrafiltrate, Sr^{85} entering more rapidly. The ratio of passage of Sr^{85} and Ca^{45} into interstitial fluid studied in one patient with massive edema indicated increased permeability of the capillaries, both isotopes entering the fluid at about the same rate. (auth)

11415
METABOLISM OF RADIORUTHENIUM IN THE WHITE RAT. II. THE EFFECTS OF WEIGHT-DOSE, pH VALUE, AND A DECORPORATION METHOD. Ernst Spode and Friedrich Gensicke (Deutsche Akademie der Wissen-

schaften, Berlin). Strahlentherapie 111, 476-81(1960) Mar. (In German)

The influence of size of dose and pH value of the injection solution on the distribution and excretion of $Ru^{106}Cl_3$ in mice is described. Some results of decorporation experiments are reported. (auth)

11416

United States. Congress. Joint Committee on Atomic Energy.
BIOLOGICAL AND ENVIRONMENTAL EFFECTS OF NUCLEAR WAR. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION, JUNE 22-26, 1959. PART I. 972p. GPO.

Hearings were held on June 22 through June 26, 1959. Separate abstracts were prepared on 34 statements presented to the Committee. (C.H.)

11417

Defense Atomic Support Agency, Washington, D. C.
[EFFECTS OF NUCLEAR WEAPONS]. STATEMENT OF DR. FRANK SHELTON. P. 15-43 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

The effect of a nuclear war is the sum of the effects of the weapons employed against the individual targets. The effects of blast, thermal radiation, and prompt nuclear radiation will not usually overlap the same areas with important effects unless two or more bombs are detonated close to a single target. Local fall-out from surface bursts is about the only effect overlapping from one bomb to another, especially true in the downwind directions. A nuclear explosion is described, differences in air bursts and surface bursts are discussed, and the various nuclear weapons effects on man and inanimate objects are described. The effects of thermal radiation from a nuclear burst, and the effects of nuclear explosions on man are also discussed. The shelter afforded by various types of conventional structures is discussed. (C.H.)

11418

Oak Ridge National Lab., Tenn.
[DOSIMETRY OF DIRECT RADIATION FROM NUCLEAR WEAPONS]. STATEMENT OF G. S. HURST. p.140-7 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Applications of radiation dosimetry studies to the evaluation of environmental and biological consequences of nuclear war are discussed. Data are reviewed on the medical condition of individuals in Hiroshima and Nagasaki exposed to the effects of atomic explosions. Results are reported from a survey of the radiation doses for individuals located in houses in Hiroshima and Nagasaki and application of the results to problems of protection against prompt weapons radiation. Data are summarized from weapons effects studies and the shielding characteristics of various materials for prompt weapons radiation. Results are included from a Hardtack Operation study of the mutual shielding in a cluster of light frame houses. (C.H.)

11419

Los Alamos Scientific Lab., N. Mex.
[ACUTE EFFECTS OF NUCLEAR RADIATION FROM NUCLEAR WEAPONS ON HUMANS]. STATEMENT OF DR. PAYNE S. HARRIS. p.256-73 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Radiation effects from nuclear weapons which manifest themselves in humans by death within 60 days post-exposure are discussed. The source is assumed to be a nuclear weapon of from a half megaton to 10 megatons with a fission-fusion ratio of one, and detonated on the surface. The effects of immediate or initial gamma rays and neutrons from the weapon, radioactive debris blown out by the blast wave, and close-in or primary fall-out are considered. From available information, one will not get acute effects of fall-out radiation unless fall-out particles can be seen either as they come down or after deposition on the ground. The acute effects of total-body radiation due to gamma rays and neutrons are classified into four categories. These include no obvious disease, characterized by response due to the effects of radiation on the blood-forming systems, disease characterized by response due to effects of radiation on the gastrointestinal system, and disease characterized by response due to effects of radiation on the central nervous system. The prognosis for the last two groups is poor, with the last category invariably terminating in death. The importance of establishing the degree of damage in sorting and handling large numbers of casualties and in determining the course of treatment is stressed. The cardinal signs and symptoms associated with these four categories of effects on humans are summarized and are related to radiation dose ranges. It is emphasized that the acute radiation effect is dependent upon dose and time of exposure and in any population group there will be variability in response. It is generally agreed that the range 200 to 1,000 rads covers the range from inconsequential effects to death within a few weeks. Available data on human response to radiation are reviewed. It is concluded that no one single symptom or sign can be considered indicative of the course of the disease. The expected ratios of combined injury, as well as the ratios of single parameter injury, will depend heavily on the detonation environment. (C.H.)

11420

Naval Radiological Defense Lab., San Francisco.
[EFFECTS FROM PROTRACTED EXPOSURES TO NUCLEAR WEAPONS]. STATEMENT OF DR. ROBERT R. NEWELL. p.296-310 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Late effects of radiations from a nuclear explosion on persons who have survived for 3 months are considered. The effects of divided dose on subsequent radiation injuries are discussed. Data on the pathological effects of radiation on man are reviewed. Somatic injuries, leukemia, carcinoma, shortening of life-span, the induction of cataracts, the effects of chronic exposure due to fall-out, and the effects of external beta irradiation are discussed. It is pointed out that totally destructive blast and thermal radiation will extend far beyond the reach of prompt gamma and neutron rays. The survivors have to live awhile without the organization of civilization. The effectiveness of shelters as protection is considered. The basic necessities such as air, water, food, and sanitary facilities for shelters are discussed. (C.H.)

11421
[Walter Reed Army Medical Center. Inst. of Research, Washington, D. C.].
THE ACCUMULATION OF FISSION PRODUCTS IN MAN. James B. Hartgering. p.541-6 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

The detonation of multiple high yield nuclear weapons will contaminate the earth's biosphere with more than two hundred radionuclides as a result of the fissioning of uranium or plutonium plus a few nuclides secondary to the fusion process. Meteorological and geophysical factors will affect the amount of radioactivity available for assimilation into the various segments of the world's population. The deposition of fission products in man will not result in casualties in the early phases of a nuclear war, but the potential accumulation during post attack recovery is a real threat, and will require positive countermeasures. These can be developed and maximized provided basic research in human and mammalian radiobiology, decontamination, and techniques of measuring radioactivity in man are developed. (C.H.)

11422
California. Univ., Berkeley. Donner Lab.
[EFFECT OF HYPOTHETICAL ATTACK RESULTING FROM THE USE OF 2,000 MEGATONS OF FISSION IN WEAPONS]. TESTIMONY OF HARDIN JONES. p.592-610 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Estimates are presented of the injuries sustained by a population exposed to the effects of a hypothetical attack resulting from the use of 2,000 megatons of fission in weapons. It is assumed that a few would have sustained little direct exposure. In addition to ionizing radiation exposure there would be thermal burns, blindness, deafness, trauma, and pestilence. It is assumed that the rural population which remained unexposed to the violence of the explosions would shelter the small fraction of urban survivors. It is assumed that about half the population would die from a combination of radiation exposure and associated disturbances. Most of the long-term survivors would be relatively incapacitated for a period of several weeks. Estimates are included on life span reduction and bone tumor incidence from radiostrontium. (C.H.)

11423
Office of Civil and Defense Mobilization, Battle Creek, Mich.
[CASUALTY ESTIMATES FOR NUCLEAR WAR]. Eugene Quindlen. p.843-58 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Casualties are computed from a hypothetical nuclear attack on the United States. The casualty percentage is calculated for various regions and cities from direct blast and thermal and nuclear radiations. The probable fall-out dose at various locations was also calculated. The percentage of the population killed and made ill by the fall-out dose was computed, taking into account the shielding by homes, basements, and other places where people may take cover. (C.H.)

Biochemistry, Nutrition, and Toxicology

11424 CEA-1226
France. Commissariat à l'Énergie Atomique, Paris.
DOSAGE DE L'URANIUM DANS L'URINE (^{233}U). (Determination of Uranium (U^{233}) in Urine). L. Jeanmaire and H. Jammet. 1959. 5p.

A procedure for the quantitative analysis of uranium in urine is described. The residue obtained by mineralization is dissolved in diluted hydrochloric acid. Uranium is separated by fixation on a permutite-50 column, elution with 0.2 M oxalic acid and electrodeposition on nickel. Uranium is then measured by α counting. It is thus possible to detect less than 1 micromicrocurie of uranium in the sample. (auth)

11425 CEA-1228
France. Commissariat à l'Énergie Atomique, Paris.
DOSAGE DU RADIUM DANS L'URINE. (Determination of Radium in Urine). H. Fourniguet, L. Jeanmaire, and H. Jammet. 1959. 8p.

A procedure for the quantitative analysis of radium in urine is described. The radium is carried down by a barium sulfate precipitate. The precipitate is mixed with zinc sulfide and the activity measured by scintillation counting. It is thus possible to detect an amount of radium less than 1 micromicrocurie in the sample. (auth)

11426 CWL-TM-27-7
Chemical Warfare Labs., Army Chemical Center, Md.
THE TOXICOLOGY OF BORON HYDRIDES. George J. Levinskas. Dec. 1956. 28p. Contract DA-18-108-CML-5415.

A subacute and chronic inhalation study was conducted with pentaborane. The former, at 1.0 ppm, resulted in the death of several animals within four weeks (20 exposures). The chronic study was conducted at 0.2 ppm of pentaborane for approximately six months. During this period, the animals showed a loss of appetite, weight loss, apathy, docility, decreased physical activity, and muscle tremors. Less frequently observed were an insensitivity to pain, impaired mobility of the limbs, and signs of eye and nasal irritation. The exposed rats showed an elevated hematocrit. The exposed dogs showed signs of liver damage as measured by the bromsulfalein test. While no marked impairment of excretory ability was detected, the exposed dogs frequently showed blood levels of the dye in excess of 10% and 5% for 20 and 45 minutes, respectively. All of the other tests gave values within normal limits. It is suggested that, where the possibility of prolonged and repeated exposure to this chemical exists, adequate ventilation be provided to keep the concentration of pentaborane below 0.2 ppm. (auth)

11427 HW-13949
Hanford Works, Richland, Wash.
URINE ANALYSIS FOR TRITIUM OXIDE. J. W. Healy. July 27, 1949. Decl. Mar. 2, 1960. 6p. OTS.

A procedure is described which is based on the production of acetylene from the water sample followed by measurement of the ionization due to the tritium beta particle. Interpretation of results is discussed. (J.R.D.)

Fallout and Radiation Ecology

11428 AERE-R-3246
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
RADIOACTIVE AND NATURAL STRONTIUM IN HUMAN

BONE, U.K. RESULTS FOR 1959. PART I. J. W. Arden, F. J. Bryant, E. H. Henderson, G. D. Lloyd, and A. G. Morton. Jan. 1960. 9p. BIS.

Data are tabulated on the content of strontium-90 and natural strontium in samples of human bone samples analyzed during 1959. Some of the samples were from subjects who died in 1957 and 1958. The strontium units show a rise in the under 20 age group between the latter part of 1958 and the first half of 1959. The higher bone-burdens reflect contamination of the diet by fall-out during this period. (C.H.)

11429 HW-63654

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

OFF-PROJECT EXPOSURE FROM HANFORD REACTOR EFFLUENT. R. F. Foster and R. L. Junkins. Feb. 1, 1960. 47p. OTS.

A review of data on the discharge of reactor effluent water to the Columbia River, including calculated and measured radioactivity downstream, relative to permissible limits was made. A description of the quantities of radionuclides in the river was given. Calculated and measured exposures from drinking Columbia River water are presented. The exposure from the consumption of foods is estimated. A description is given of the distribution of Columbia River water in the ocean. The radionuclide content of marine organisms was investigated. (auth)

11430 RIGO-1959/1

Netherlands. Gezondheidsorganisatie, TNO. Radiologisch Instituut, Rijswijk *and* Netherlands. Rijksverdedigingsorganisatie, TNO. Medisch Biologisch Laboratorium, Rijswijk.

RADIOACTIEF STRONTIUM IN GROND, GEWASSEN, VOEDINGSMIDDELEN EN MENSELIJK BOT IN NEDERLAND. DEEL I. (Radioactive Strontium in Soil, Crops, Foodstuffs, and Human Bones in the Netherlands. Part I). G. W. Barendsen, T. L. J. Beusker, J. F. Bleichrodt, and T. H. L. van Beukering. Feb. 1959. 36p. (MBL-1959/4).

Measurements of Sr^{89} and Sr^{90} in soil, grass, milk, and foodstuff samples are reported. Analyses of human urine were made which show wide daily variations. Human bone samples from children up to 15 yr age were studied. The results agree with those from the U.K. and the U.S.A. (T.R.H.)

11431

ON THE EFFECT OF ETHYLENEDIAMINETETRAACETATE (EDTA) ON THE ACCUMULATION COEFFICIENT OF DIFFERENT RADIOISOTOPES FROM AQUEOUS SOLUTION BY FRESH-WATER PLANTS. E. A. Timofeeva-Resovskaya, and N. V. Timofeev-Resovskii (Inst. of Biology, Urals Div., Academy of Sciences, USSR). *Doklady Akad. Nauk S.S.S.R.* *130*, 210-13(1960) Jan. 1. (In Russian)

The effects of ethylenediaminetetraacetate on the accumulation coefficients of Ce^{144}, Co^{60}, Cs^{137}, Fe^{59}, Nb^{95}, Ru^{106}, S^{35}, Sr^{90}, Y^{91}, Zn^{65}, and Zr^{95} from aqueous solutions were studied. Eight grams of elodea (*Elodea canadinsis Rich.*), aquatic plant (*Ceratophyllum demersum* L), duckweed (*Lemna minor* L.), and chara (*Chara fragilis Desw.*) were placed in three liters of water containing 400 mg of EDTA per liter. Tabulated data show 4 groups of isotopic reactions to EDTA. The first group includes strontium and cesium (whose uptake increases in the presence of EDTA), the second is represented by sulfur (which does not react to EDTA), the third group consists of zirconium, niobium, and ruthenium (whose uptake is reduced 2 to 3 fold in the presence of EDTA), and the fourth group contains iron, cobalt, zinc, yttrium, and cerium (whose uptake is reduced 10 to 100 fold). (R.V.J.)

11432

FALL-OUT OVER NORWAY FROM HIGH-YIELD NUCLEAR EXPLOSIONS. T. Hvinden, D. Hveding, A. Lillegraven, and S. H. Small (Norwegian Defence Research Establishment, Kjeller). *Nature* *185*, 805-7(1960) Mar. 19.

Results are reported from measurements of fall-out from high-yield nuclear explosions made in Norway between September 1956 and January 1960. Fall-out materials which rise well into the stratosphere after high-yield test explosions began to reach the lower stratosphere over south-east Norway shortly afterwards. The radioactivity in the lower stratosphere increased to a peak about one to two months after the explosions and then decreased with an effective half life of about a month. The radioactivity of fall-out materials in air near the ground increased shortly after the explosion, but much more slowly, and reached a peak considerably lower than the peak in the lower stratosphere after six to seven months. (C.H.)

11433

MOVEMENT OF RADIOSTRONTIUM IN SOILS. KNOWLEDGE OF CLIMATIC AND SOIL FACTORS IS IMPORTANT IN DETERMINING THE REDISTRIBUTION OF STRONTIUM FALLOUT. C. W. Thornthwaite, J. R. Mather, and J. K. Nakamura (Lab. of Climatology, Centerton, N. J.). *Science* *131*, 1015-19(1960) Apr. 8.

Climatic and soil factors which affect the movement of radiostrontium in soils are discussed. A mathematical model of strontium movement through soils was developed from the results of laboratory experiments. It is concluded that if soils over the earth should be seriously contaminated through weapon testing or radiological warfare, the natural processes of soil purification through leaching would proceed at different rates in different areas. (C.H.)

11434

Medical Coll. of Virginia, Richmond; New York Univ., New York. Post-Graduate Medical School; *and* Defense Atomic Support Agency, Washington, D. C.

THERMAL INJURY FROM NUCLEAR WEAPONS. STATEMENTS OF WILLIAM T. HAM, JR., GEORGE MIXTER, JR., AND CHARLES H. FUGITT. p.230-56 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

In event of a nuclear attack, fire may impose a much greater hazard to people and buildings than the fall-out. It is believed that fire storms are an almost inevitable consequence of a magaton drop on a large city. Survivors of the initial effects of blast, and thermal and ionizing radiations from a megaton burst must cope with the incinerating heat of fire storms before they cope with the problem of fall-out radiation. Severe burn casualties from secondary fires will vastly outnumber flash burn casualties from the fireball. Under the conditions stipulated, the hazards of flash blindness and retinal damage would be negligible. It is pointed out that nuclear warfare would produce severe burn casualties out of all proportion to any previous medical experience. Data are summarized from weapons tests on biological effects of thermal radiation, flash blindness, and retinal burns. (C.H.)

Radiation Effects on Living Tissues

11435 AD-229152

National Canners Assn. Western Research Lab., Berkeley, Calif.

DETERMINATION OF RELATIVE RESISTANCE OF SE-

LECTED STRAINS OF CLOSTRIDIUM BOTULINUM TO IONIZING RADIATIONS. Report No. 3 (Progress) [for] January 14, 1959–April 13, 1959. Charles T. Townsend. 6p. Project No. 7-84-01-002. Contract DA-19-129-QM-1184.

Results are tabulated from a study of the radiosensitivity of spore suspensions of sixteen strains of Clostridium botulinum. (C.H.)

11436 AERE-R-3204

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AN INVESTIGATION INTO THE SUITABILITY OF VARIOUS PLATING MEDIA FOR COUNTING IRRADIATED BACTERIA. Barbara M. Freeman and B. A. Bridges. Dec. 1959. 27p. BIS.

When certain bacteria are counted after irradiation, the medium on which they are plated is known to influence the number of colonies obtained. Conflicting reports about such post-irradiation medium effects prompted an investigation into their magnitude under normal laboratory conditions. Six strains of bacteria were used and five culture media. No effect of the post-irradiation medium was found with Bacillus subtilis, Streptococcus faecalis or Pseudomonas sp. With two strains of Escherichia coli and with Staphylococcus aureus the effect was small and survival was invariably best on the richest media. It is recommended that blood agar be used to obtain maximum counts of irradiated organisms. Data are also presented about the effect, on radiosensitivity, of the medium on which the cells are grown before irradiation. (auth)

11437 AF-SAM-60-5

School of Aviation Medicine, Brooks AFB, Tex. and Texas. Univ., Austin. Radiobiological Lab.

SOME EVIDENCE SUGGESTING THE PERCEPTION OF MODERATE-INTENSITY RADIATION AMONG ALBINO RATS. Loren C. Logie, W. Lynn Brown, Joseph S. Pizzuto, and John E. Overall. July 15, 1959. 6p.

Two experiments designed to test the hypothesis that albino rats perceive x radiation as a noxious stimulus are reported. Each experiment involved two conditions which were exactly alike except for the location of a protective lead shield. For half of the Ss, the lead shield was located in front of the right-hand compartment of the shuttle-boxes; for the other half, the lead shield was located in front of the left-hand compartment. In each experiment the results suggested that radiation, or its immediate consequence, was perceived by the rats; however, in each experiment the observed effect was very moderate. (auth)

11438 AF-SAM-60-17

School of Aviation Medicine, Brooks AFB, Tex.

PROMPT EFFECTS OF HIGH-LEVEL IRRADIATION ON ANIMAL METABOLISM. James P. Ellis, Jr., Robert T. Clark, Jr., Walter A. Rambach, and John E. Pickering. Aug. 14, 1959. 10p.

Blood acid-base related components and free amino acids in plasma, spinal fluid, and five tissues were measured in rhesus monkeys given whole-body irradiation doses of 500, 2,500, 5,000, 10,000, 20,000, and 30,000 r. All samples were collected within four hours following the exposure. A trend of a more acid blood pH was found in animals receiving 5,000 to 20,000 r, and became more apparent in the 30,000 r group. A rise in blood lactic acid seemed to parallel the change in blood pH. A consistent change was not found in blood pyruvate. A correlation of the more acid blood pH and the rise in blood lactate with reductions in the arterial CO_2 tension and plasma CO_2 content indicated that a metabolic acidosis was greater than a respiratory alkalosis resulting from increased pulmonary ventilation. Observations based on two-dimensional chromatograms indicated that a reduction in plasma glucose and an increase in plasma uric acid occurred in the irradiated animals. A definite relationship was found to exist between these altered levels, the postirradiation interval, and the total dose given. A twofold increase in the free amino acid content of plasma was found in animals receiving 5,000 r. The increase was not intensified by exposures in excess of 5,000 r. Variations in the amino acid content of liver, kidney, heart, spleen, and skeletal muscle obscured a change attributable to radiation. Of the seven amino acids detected in spinal fluid, an elevated glutamine level appeared to be the only consistent change and was primarily responsible for the net increase found in the total amino acid fraction. (auth)

11439 AF-SAM-60-36

Texas. Univ., Austin. Radiobiological Lab. and School of Aviation Medicine, Brooks AFB, Tex.

LEVER-PRESSING BEHAVIOR OF ALBINO RATS DURING PROLONGED EXPOSURES TO X-RADIATION. W. Lynn Brown, John E. Overall, Loren C. Logie, and James E. Wicker. Oct. 15, 1959. 11p.

Thirty-six male albino rats were first trained to respond to a 20-to-1 reinforcement ratio in a Skinner box. Following the attainment of a high response rate, the rats were randomly divided into six groups corresponding to six treatment conditions. Subsequently, the animals in the six groups were exposed to 0 r/hr, 25 r/hr, 50 r/hr, 75 r/hr, 100 r/hr, or 125 r/hr during a one-hour period in the Skinner-box apparatus each day. Changes in response rate as a function of dose rate, number of exposures, and the interaction between these variables were recorded. The largest source of variance in response rate was found to be the cumulative total dose received by the organism. A simple linear function relating the square root of response rate to the cumulative total dose was found to account for over 86 percent of the variance in average daily performance for the six groups. (auth)

11440 AFOSR-TN-60-252

Uppsala Univ. Gustaf Werner Inst. for Nuclear Chemistry.

RESEARCH ON "LOCALIZED RADIO-LESIONS." III. BLOOD VESSEL CHANGES FOLLOWING LOCAL IRRADIATION OF THE BRAIN WITH HIGH ENERGY PROTONS. Technical Report No. 1, Appendix 5. Börje Larsson. Dec. 1, 1959. 18p. Contract AF61(514)-1247.

The cerebral cortex and thalamus in the brain of the rat were locally irradiated with a narrow beam of high-energy protons. The developing radiolesion was studied with attention paid particularly to changes in capillary function. Semiquantitative comparison between effects at different times after irradiation with different doses in the region 10 to 40 krad was attempted. Three types of changes were graded: impairment of capillary circulation, increase of permeability of trypan blue through the blood-brain barrier system, and necrosis. Comparison with the results of whole-head irradiation reported in the literature showed that radiation changes of surrounding structures may indirectly contribute to the changes in the blood-brain barrier system in the region of study. The importance of performing experiments on the effects of local irradiation of the central nervous system under well defined conditions as regards localization and dose-distribution is therefore stressed. Circulatory disturbances seem to precede the blue-staining of irradiated brain tissue. As a matter of further discussion a hypothetical mechanism in consistency with observation and modern concepts of the constitution of the blood-brain barrier system is out-lined. The mechanisms involved in the rapid development of lesions described here might be different from those involved in the production of late delayed radionecrosis. The results show that the detection of changes in the blood brain barrier system with suitable dyes or radioactive compounds may be applied as a means of early diagnosis of the radiolesion. (auth)

11441 AFOSR-TN-60-254
Uppsala Univ. Gustaf Werner Inst. for Nuclear Chemistry and Stockholm. Univ. Zootomical Inst.
RESEARCH ON "LOCALIZED RADIO-LESIONS." V. OBSERVATIONS ON PIGEONS DECREBRATED WITH HIGH ENERGY PROTONS. Technical Report No. 1, Appendix 3. Eric Fabricius and Börje Larsson. Apr. 1, 1959. 26p. Contract AF61(514)-1247.

Four pigeons were decerebrated by radiolesions produced by 185 Mev protons from a synchrocyclotron. The cerebral peduncles were cut off at the level of the anterior commissure and the bending point of the tractus septomesencephalicus. Escape response and spontaneous feeding and drinking disappeared in all the birds, as well as all social behavior, including calling, but the ability of walking, standing in a normal position, and maintaining the equilibrium remained. All birds lost the ability of passing food from the crop into the stomach. In one not totally decerebrated bird a small volume of brain tissue was left intact between the lesion and the level of the anterior commissure as well as at the ventral surface of the forebrain. This bird was observed to fly spontaneously. When flying it could avoid obstacles and select suitable objects for landing. In two totally decerebrated birds the lesion was situated rostral to and reached the level of the anterior commissure leaving no intact telencephalic brain tissue caudal to the necrotized area. These birds flew when thrown into the air, and they turned towards the light when flying. When landing they stretched out the feet at a certain distance from the floor, showing that some ability of visual estimation of distances remained. The pupillar reflex: to light and blinking at approaching objects persisted in these birds. In one totally decerebrated bird the thalamus was destroyed and the rostral surface of the tectum slightly damaged. This bird could not fly, but it spread its wings and tail and performed wing beats when suddenly moved downwards. The pupillar reflex to light and blinking at approaching objects disappeared while blinking when touch persisted. The method of producing lesions by a proton beam proved promising for functional studies on the bird brain. The lesions were distinctly restricted. No damage to surrounding structures, and no condition of shock were observed. (auth)

11442 ORNL-2903
Oak Ridge National Lab., Tenn.
BIOMETRIC ANALYSIS OF A GROWTH RESPONSE OF TWO PLANT SPECIES IN A RADIOACTIVE WASTE AREA. G. L. Plummer. Apr. 25, 1960. 9p. Contract W-7405-eng-26. OTS.

Lengths of pistillate inflorescences of sedges (Carex spp.) growing in the contaminated soils of White Oak Lake bed were measured in relation to radiation fields. Carex Frankii Kunth and Carex vulpinoidea Michx. populations were sampled from areas with air dose rates of 0, 10, 20, and 40 mr/hr. Analyses of variance showed that mean lengths of inflorescences of C. vulpinoidea were similar to each other in these areas but that those of C. Frankii were significantly different. However, the sites differ in such factors as soil moisture, fertility, and alkalinity, so that these differences in the length of inflorescence may not be accounted for primarily by the exposure dose rate of the radiation field. (auth)

11443
SPLEEN-SHIELDING IN X-IRRADIATION-ACCELERATED EXPERIMENTAL AMYLOIDOSIS IN MICE. H. E. Christensen and G. H. Hjort (University Inst. of Pathological Anatomy, Copenhagen). Acta Pathol. Microbiol. Scand. 48, 1-12(1960). (In English)

An accelerating effect was previously found for x irradiation in total-body exposure to 400 r in mice made amyloidotic with caseinate injections. Results are presented from investigations with the use of lead-shielding of the surgically exteriorized spleen or of the body (only the spleen irradiated) under 400 r irradiation of mice with caseinate-induced amyloidosis. The conclusion is drawn that the accelerating effect of x rays in this kind of amyloidosis is not only part of a general stress reaction, but a direct one exercised on the cells of the reticular tissue, which are active in the production of amyloid. (C.H.)

11444
VERTEBRATE RADIOBIOLOGY (EMBRYOLOGY). Roberts Rugh (Columbia Univ., New York). Ann. Rev. Nuclear Sci. 9, 493-522(1959).

Data on x radiation effects on marine organisms, fish, chicks, rats, mice, and man are reviewed. (C.J.G.)

11445
BIOCHEMICAL EFFECTS OF IONIZING RADIATION. Margery G. Ord and L. A. Stocken (Oxford Univ., Eng.). Ann. Rev. Nuclear Sci. 9, 523-52(1959).

Data on the biochemical effects of ionizing radiation in carbohydrate, fatty acid, and protein metabolism of various animals are reviewed. Changes in enzyme activities after irradiation in vivo and in vitro are discussed. Data on irradiation damage to nucleic acids and nucleoproteins are reviewed. The influence of oxygen on the response of cells and tissues to ionizing radiation is discussed. Descriptions of substances which can exert protective effects to ionizing radiation under certain conditions are given. (C.J.G.)

11446
CELLULAR RADIOBIOLOGY. K. C. Atwood (Univ. of Chicago). Ann. Rev. Nuclear Sci. 9, 553-92(1959).

Data on radiation damage to biomolecules are reviewed. The influence of oxygen on the end effects of irradiation is discussed. Data on microbial survival and mutation are reviewed. The validity of statistical microscopy is examined. Radiation experiments in phage replication are discussed. Aspects of chromosomal damage and mutagenesis in higher animals and plants are discussed. Data on post-irradiation biochemical and morphological changes are reviewed. Partial cell irradiation techniques are described. Beneficial effects of radiation are discussed. (C.J.G.)

11447
BIOCHEMICAL MODIFICATIONS INDUCED BY IONIZING RADIATION ON HEPATIC CELLS: CYTOCHROME OXIDASE ACTIVITY. Franco Pozza and Gabriele Verza. Atti ist. veneto sci. lettere ed arti, Classe sci. mat. e nat. 117, 237-40(1958-1959). (In Italian)

A study was made of the activity of the (enzyme with –SH groups of basic importance in the cellular oxide reduction processes) hepatic tissue of the rat exposed to whole-body irradiation. From determinations made from 1 to 24 hours after the end of x irradiation (2000 r in a single dose and 2000 r divided into four doses) of the cytochrome oxidase activity of the rat liver, a slight increase of the enzyme function was found only in the case of single dose irradiation after one hour. In other cases a moderate decrease of the activity was found. The possibility that these apparently discordant results are expressions of the same harmful effects observed previously is discussed. (J.S.R.)

11448

IMPROVING THE BAKING QUALITY OF FLOUR BY IRRADIATION WITH IONIZING RADIATION. M. Blinc. Brot u. Gebäck 12, 237-41(1958). (Translated from Referat. Zhur. Khim. No. 11, 1959, abstract No. 40488).

The effect of the irradiation of two types of wheat flour with ionizing radiation in doses of $30 \cdot 10^3$ to $500 \cdot 10^3$ was studied. The radiation effects were evaluated from the study of the organoleptic and physicochemical parameters of test batches of bread. In addition, the effect of irradiation on the gluten (G) was studied. Good results were obtained when samples of flour of both types were irradiated with $30 \cdot 10^3$ to $50 \cdot 10^3$ rep. The dough in these cases showed better physicochemical properties than those achieved by mixing with control flour or with flour exposed to large doses of radiation; the bread obtained had a better volume yield, a better taste, crust, and consistency, as well as greater resistance to staling than bread baked from control flour or from flour subjected to high radiation doses. The same results were obtained in the tests in which the quality of the G was compared: the above-indicated optimum radiation dosages improved G quality (color, structure, elasticity, and ductility), whereas higher dosages resulted in a deterioration of G quality. Differences in the UV and IR absorption spectra of aqueous G extracts are noted and an amylographic analysis of specimens irradiated with varying doses of radiation and of unirradiated specimens of G is given. The G was dried in a stream of warm air and converted to a powder which was dissolved in NaOH and coagulated at pH 4.5 to 4.6; in all instances no differences could be detected here [original unclear] either in the degree of flocculation or in the precipitation of various substances.

11449

ACTIONS OF GAMMA RADIATION ON ENZYMES AND ENZYME SYSTEMS. Shozo Tanaka, Hiroyuki Hatano, Shigetake Ganno, and Toshio Okamoto (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 374-91(1959) Dec.

The effects of γ radiation on several enzymes, coenzymes, and multienzyme systems were studied. Conditions which affect the inactivation of enzymes and a coenzyme were studied. The inhibitions of enzyme activities were proved to occur exponentially with dose. G-values of enzyme inactivations depended on the concentration of enzyme solutions. Previously added thiol compounds were found to protect the inactivation of sulfhydryl enzymes by γ irradiation. Radiolytic damages to enzymes and coenzymes were investigated quantitatively. Ion exchange chromatography confirmed inorganic phosphate splitting which occurred when diphosphopyridine nucleotide received relatively large γ doses. A study of the biochemical effects of γ rays on enzymes proved that some were more radiosensitive than others. (B.O.G.)

11450

STUDIES ON γ-RAY IRRADIATED BOVINE PLASMA ALBUMIN SOLUTION. Masaru Sogami (Yamaguchi Medical Coll., Ube, Japan) and Yoshihiro Tamura, Yasuo Imai, and Yoshiya Shinagawa (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 392-9(1959) Dec.

Subfractionation techniques were used in studies of γ irradiated protein solutions. That is, the changes in chromatogram were more radiosensitive than those of viscosity, absorption spectrum, and amperometric titration of -SH groups. The effects of dose rate, protein concentration, pH, and salts on irradiation changes in protein solutions were investigated. It was found that these factors produced the marked effects. (auth)

11451

EFFECTS OF THE MOISTURE CONTENT ON γ-RAY SENSITIVITY IN ARTEMIA EGGS. Tamiko Iwasaki (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 400-4(1959) Dec.

Artemia eggs of various moisture contents were irradiated with γ-rays and then soaked in 2% NaCl solution at 27°C. After 72 hours hatchability was measured. On the basis of the measurement, the radiosensitivity of the eggs increased successively with an increase of moisture content. The eggs, moistened prior to irradiation, were redesiccated to the initial level of moisture content. Their sensitivity was shown to return to almost the initial level. To test the influence of temperature, the eggs were infiltrated with moisture at 0° and 25°C and then irradiated at low or high temperature, but there was no marked difference in their sensitivity. The sensitivity of eggs irradiated at the higher temperature was found much higher than those irradiated at the lower temperature. (auth)

11452

INCORPORATION OF P^{32} INTO EUGLENA CELLS EXPOSED TO γ-RADIATION. Masahiro Ruè Ishida and Saburo Matsuoka (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 405-7(1959) Dec.

After Euglena cells were irradiated with a γ dose of 1×10^5 r, the cells were cultured for times of 1, 6, 12, and 24 hours in a culture medium containing 0.1 μc P^{32} per ml. Cell fractionation was carried out by a modified Schmidt and Thannhauser's method. Incorporation of P^{32} was observed on each of acid soluble, lipid, DNA, RNA, and phosphoproteid fractions obtained by this method. From the experiments, the following tentative conclusions were obtained; incorporation of P^{32} into nucleic acids and other phosphorus containing substances is inhibited by γ irradiation. The results show γ-irradiation markedly inhibits an increase of the cell population. (auth)

11453

RESPONSE OF γ-IRRADIATED BACTERIA TO NUTRITIONAL SUBSTANCES SUPPLEMENTED TO THE POST-IRRADIATION CULTURE MEDIUM. Hajime Kadota, Hideo Miyoshi, and Hiromu Shibata (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 408-16(1959) Dec.

The response of γ-irradiated bacteria to nutritional substances differed considerably with species (or strains); the increase of survival by the addition of nutritional substances was greater in bacteria capable of growing without any growth factor (e.g., Escherichia coli and Serratia marcescens) as compared with organisms which require a variety of organic substances for growth (e.g., Proteus morganii and, particulary, spores of Bacillus subtilis). On the basis of these findings, the relationship between the processes involved in the "recovery" of bacterial cells inactivated by γ-radiation and the biosynthetic systems contained in the cells of each species (or strain) is discussed. Evidence was obtained with Escherichia coli and Serratia marcescens which indicated that most of the irradiated cells showing induced nutritional requirements were not stable auxotrophic mutants. (auth)

11454

RADIOBIOLOGICAL STUDIES ON PLANTS. III. SENSITIVITY OF SEEDS OF WHEATS AND OATS TO GAMMA-

RAYS FROM Co^{60}. Ichizo Nishiyama, Masasuke Okamoto, and Takeo Maruyama (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 417-24(1959) Dec.

The effects of gamma rays on wheats and oats were investigated in an effort to establish differences in the effects according to the species. Sensitivity was expressed by germination rate, survival rate, development above- and underground, and the degrees of developmental disturbances to the first and third leaves. The results are tabulated. (B.O.G.)

11455

THE EFFECT OF GAMMA RADIATION ON SPROUT PREVENTION AND ITS PHYSIOLOGICAL MECHANISM IN THE POTATO TUBER AND THE ONION BULB. Kuniyasu Ogata, Takashi Iwata, and Kazuo Chachin (Univ. of Osaka Prefecture, Sakai, Japan). Bull. Inst. Chem. Research, Kyoto Univ. 37, 425-36(1959) Dec.

Potato tubers and onion bulbs were irradiated with γ rays at 3000, 7000, and 12000-r levels to investigate sprout prevention and physiological mechanisms. The potatoes were irradiated during the dormant period and at the beginning of the sprouting period. Bud growth on tubers of the 3000-r lot was more vigorous than on the control specimens. Buds on the 12000-r lot were completely suppressed, while some of the 7000-r lot developed buds 3 months late. Sugar content and oxygen uptake increased immediately after irradiation but declined sharply thereafter. The onions were irradiated soon after harvest and at the pre-sprouting period. Their sprouting was completely inhibited even at 3000 r. It was observed that the irradiation did not cause any important alteration on growth promoting and inhibiting substances in the inner bud. (B.O.G.)

11456

STUDIES ON THE UTILIZATION OF INDUCED MUTATION FOR SUGAR BEET BREEDING. I. SENSITIVITY OF SUGAR BEET TO γ-RAYS (Co^{60}). Katsumi Syakudo and Akio Ujihara (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 437-9(1959) Dec.

Dry dormant seeds of sugar beet were irradiated with Co^{60} γ rays of 40 to 1,000 kr in order to determine the radiosensitivity of this plant as a first step to the utilization of induced mutation for sugar beet breeding. It was found that even at 300 kr the seed showed a high germination rate, although seedlings irradiated with more than 70 kr gradually died in the process of development. From these results it was concluded that the γ dosage appropriate for a mutation study in sugar beets is around 40 kr. In almost all varieties used the plants which developed from the irradiated seeds showed a slower growth than the controls. No difference was observed between diploid and polyploid radiosensitivity. (auth)

11457

BONE MARROW TREATMENT OF MICE LETHALLY IRRADIATED WITH GAMMA-RAYS UNDER HIGH DOSE RATE. I. EFFECT OF ISOLOGOUS BONE MARROW. Morihisa Yamagishi (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 440-52(1959) Dec.

Mice were irradiated lethally with gamma rays at high dose rates and were treated with isologous bone marrow. The irradiated mice responded well to the bone marrow treatment as evidenced by rapid improvement in the peripheral blood picture, body weight, and histological findings of the hematopoietic organs, as well as by the reduced mortality rate. (auth)

11458

BONE MARROW TREATMENT OF MICE LETHALLY IRRADIATED WITH GAMMA-RAYS UNDER HIGH DOSE RATE. II. EFFECT OF HOMOLOGOUS BONE MARROW. Morihisa Yamagishi (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 453-60(1959) Dec.

Dd/s strain mice, male and female, were lethally irradiated with gamma rays at high dose rates and were treated with homologous na2 strain mouse bone marrow. Although a 14 day survival rate was fairly good, 30 day survival was generally low except for one experiment using female mice. However, most of the mice which survived for the initial 30 days in this experiment died during the subsequent 30 days. (auth)

11459

BONE MARROW TREATMENT OF MICE LETHALLY IRRADIATED WITH GAMMA-RAYS UNDER HIGH DOSE RATE. III. EFFECT OF ISOLOGOUS BONE MARROW ADMINISTERED AT VARIOUS POST-IRRADIATION DAYS. Morihisa Yamagishi (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 461-7(1959) Dec.

Isologous bone marrow cells were injected at various post-irradiation days to dd/s strain mice lethally irradiated with gamma rays at high dose rates, and the survival rate, body weight change, and histology of hematopoietic organs were studied. Unless irradiated mice took an early downhill course, a good survival rate was obtained even if bone marrow treatment was delayed up to four days after exposure. Treatment at 5 days still resulted in the survival of a small percentage of irradiated mice. (auth)

11460

EFFECT OF GAMMA-RAY IRRADIATION ON ADRENOCORTICAL ACTIVITY OF ALBINO RATS. Tadashi Miyake, Takeshi Setsuda, and Hideo Muranaka (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 468-75(1959) Dec.

The biological effects of γ and x rays on albino rats were investigated following 900-r doses, with special reference to body weight and survival time. The adrenal weight increased from the fourth day after exposure. Analyses indicated increases in the urinary formaldehydogenic steroids (FGS) on the first and third day after exposure to 900-r of x rays and decreased gradually until the rat died. The response of urinary FGS to ACTH-Z on the 2nd and 5th day after irradiation revealed low adrenocortical activity. It was found that rats injected with ACTH-Z in a four-unit dose on the second day after exposure survived longer than those not injected or injected on the fifth day. (B.O.G.)

11461

THE EFFECT OF VERY HIGH DOSES OF X-RAY IRRADIATION ON THE CONTENT OF AMINO ACIDS, PROTEINS AND NUCLEIC ACIDS IN THE WHEAT PLANT. I. M. Vasil'ev, E. I. Maslova, and O. I. Parfenova (Inst. of Biological Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 130, 206-9(1960) Jan. 1. (In Russian)

Additional data on the accumulation of amino acids, proteins, and nucleic acids in wheat plants irradiated with 300,000 r indicate that exposure to the higher dosage produces no reduction in acid content. Moreover, there is a tendency toward acid accumulation due to the depression of plant growth while photosynthesis, mineral supply, and other processes continue. (R.V.J.)

11462

MUTATIONS IN EINKORN WHEAT INDUCED BY X-RAYS. V. RECOVERY OF CHLOROPHYLL CONTENT IN SOME MUTANTS AND DOUBLE RECESSIVE SEGREGANTS. Tarô Fujii (National Inst. of Genetics, Misima, Japan). Idengaku Zasshi 34, 261-7(1959) Aug. (In English)

A study was made of the recovery of chlorophyll content in the double recessive plants from the crosses between basi-viridis II and four other mutants, and between striata and chlorina or basi-viridis II. Experiments on chlorophyll formation of the virido-albina mutant are also reported. (auth)

11463

RADIATION AND GRAFTS. P. Desaive (Université, Liège). J. belge radiol. 42, 641-55(1959). (In French)

The use of radiation in radiotherapy and tissue and cell grafts is discussed. The role of radiation in the taking of grafts is emphasized, and the use of bone marrow grafts in radiation injuries is pointed out. (T.R.H.)

11464

LESIONS PRODUCED BY INTRACEREBRAL IMPLANTATION OF IRIDIUM-194 GRAINS. A. Wambersie, J. Maisin, and J. M. Brucher (Université, Louvain, Belg.) and R. Constant (C.E.N., Mol, Belg.). J. belge radiol. 42, 688-709 (1959). (In French)

The results are reported of a study on intracerebral implants of iridium 194 seeds in 50 rabbits, a detailed description is given of the observed lesions in the animals killed a few days after implantation and in others examined thirty days after it. These results prove the utility of radioactive seed implants in cerebral tissue for the destruction of a limited area; Ir^{194} appears to be of special interest for experimental and clinical use. (auth)

11465

TUMORS OTHER THAN LYMPHOSARCOMAS INDUCED IN C_{57}BL MICE BY WHOLE-BODY IRRADIATION WITH RADIOCOBALT. D. J. Mewissen (Université, Liège). J. belge radiol. 42, 710-22(1959). (In French)

A total of 26 non-lymphoid neoplasms was observed between the 360th and the 1048th day in 194 C_{57} BL mice, surviving after total-body irradiation, with or without pretreatment with cysteamine or cystamine. Numerous hepatomas, one alveolar adenoma of lung and glandular epitheliomas of the stomach and anal canal were histologically identified. Neither cysteamine nor cystamine apparently modify the incidence of those radiation induced tumors. (auth)

11466

DIRECT EFFECT OF X RAYS ON THE CONCENTRATION AND OXIDATION OF IODIDES BY THE THYROID OF RAT. Edmond Malaise and Jacques Closon (Université, Liège). J. belge radiol. 42, 723-37(1959). (In French)

The histology of the thyroid gland in rats, its capacity to concentrate iodides and their oxidation immediately after external irradiation of the gland (60,000 r/skin) was studied. It was concluded that during the first hours after irradiation no changes in the histological structure were observed, nor can cellular radiolesions, only edema, be observed later. Immediately after irradiation, concentration and oxidation are normal. Thus roentgenirradiation of the thyroid gland does not determine direct biochemical lesions of the enzymatic systems which are responsible for these processes. (auth)

11467

RADIOSENSITIVITY OF THE PRE-IRRADIATED YOSHIDA SARCOMA. Koichi Kaneta and Nobuyoshi Muta (Sapporo Medical Coll.). Nature 185, 858-9(1960) Mar. 19.

Results of an experimental study on the radiosensitivity of tumor cells indicate that a pre-irradiated line of Ehrlich ascites carcinoma cells is more radiosensitive than the control. (C.H.)

11468

BIOLOGICAL RADIATION EFFECTS. H. J. Groenewold. Ned. Tijdschr. Natuurk. 25, 77(1959). (In Dutch)

Radiation effects and dosimetry in biological materials are discussed. (Reactor Centrum Nederland).

11469

RADIATION AVOIDANCE IN THE MOUSE. Howard L. Andrews and Louis M. Cameron (National Cancer Inst., Bethesda, Md.). Proc. Soc. Exptl. Biol. Med. 103, 565-7 (1960) Mar.

Ability of mice to recognize presence of x-ray beam, and to consider it obnoxious, has been investigated. At 50 r/minute and above there is an increasing avoidance of the radiation beam. Avoidance may be due to presence of ozone and oxides of nitrogen, although this seems unlikely from results of controlled ventilation experiments. Direct visual clues from fluorescence in the plastic cage are not responsible for the avoidance. (auth)

11470

PRODUCTION OF LESIONS IN GUINEA PIG BRAIN BY RADON SEEDS. William V. Trowbridge and Earl Eldred (Univ. of California, Los Angeles and Veterans Administration Hospital, Long Beach, Calif.). Proc. Soc. Exptl. Biol. Med. 103, 568-70(1960) Mar.

Gold and glass radon seeds of varying strength were inserted into one cerebral hemisphere of mature guinea pigs and duration of survival up to one week observed. Animals having glass seeds of greater initial strength than 1.5 mc died within 2 days, whereas those with seeds of less than 0.7 mc survived. As glass seeds of about 0.5 mc produce lesions several millimeters in diameter, they may be used for short-term experimental production of lesions in this small animal. Gold seeds, however, cannot be used for this purpose. (auth)

11471

BASIC PROCESSES OF RADIATION EFFECTS IN BIOLOGICAL SYSTEMS. Hermann Engelhard (Universität, Göttingen, Ger.). Strahlentherapie 111, 371-6(1960) Mar. (In German)

Denaturation of proteins by primary energy uptake independent of temperature must be distinguished from successive reactions of denaturation dependent on temperature. The successive reactions are decreased by cysteine and increased in a greater salt concentration. Due to the dependence of temperature of this successive reaction, cysteine gives protection if irradiation and cysteine admixture was given at a temperature of about 0°C. The dose effect curves agree if the effect of ionizing radiation is studied on mortality rate, fermentation, and mineral metabolism of yeast. However, the sensitivity of the mineral metabolism is only $^1/_5$ of the sensitivity of the mortality rate and the dose effect curve of fermentation shows a very different course, despite close correlation of mineral metabolism and carbohydrate metabolism. Cysteine is only effective for yeast if it is added subsequent to the irradiation. The results demonstrate that for all events the somatic damage must not be neglected. (auth)

11472

THE GENETIC BURDEN TO THE POPULATION FROM MEDICAL USE OF IONIZING RADIATION. PART V. VALUE AND VARIATION RANGE OF TEST FREQUENCY AND MEASURED DOSE IN TEN LARGE AND SMALL HOSPITALS AND IN FREE X RADIATION PRACTICE. Walter Seelentag, Eleonore Seelentag-Lupp, and Erich Klotz (Universität, Munich). Strahlentherapie 111, 435-67(1960) Mar. (In German)

Average doses were determined on a total of 1759 patients, and studies were made in 10 different types of hospitals, and in office practice, giving information about frequency, sex- and age-distribution of the x-ray examinations of a population of about 750,000. An average gene dose of about 14 mr per year and person was found in Germany. The attainable minimum dose is 5 mr, the possible maximum dose is 160 mr. The results were compared with reports from Denmark, England, Sweden, and the USA. The importance of good care and knowledge of a rational examination technique was pointed out. (auth)

11473
THE RECEPTOR SUBSTANCE FOR T5 V PHAGE. THE RECEPTOR ACTIVE AREA. Wolfhard Weidel and Jürgen Homann (Max-Planck-Institut für Biologie, Tübingen, Ger.). Z. Naturforsch 15b, 34-7(1960) Jan. (In German)

Highly purified T5-receptor substance was irradiated with x rays, and a one-hit dose response was obtained. By comparing quantitatively the results of two independent tests, both of which measure "survival" of receptor after irradiation, it was possible to conclude that the receptor-active site of one receptor particle must be larger than the cross section of a T5 phage tail. However, since receptor particles were never definitely observed to have combined with more than one T5 particle, secondary processes must be involved in the binding reaction, leading to a rapid inactivation of any surplus receptor-active areas on the receptor particle undergoing the reaction. (auth)

11474
School of Aviation Medicine, Randolph AFB, Tex.
[EFFECTS OF CHRONIC LOW-LEVEL RADIATION EXPOSURE]. STATEMENT OF COL. J. E. PICKERING. p.274-94 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Results are reviewed from a number of experiments on animals of the long-term effects of exposure to small doses of ionizing radiation. The animals were exposed for periods up to 8 years and to doses ranging from a quarter of a roentgen per hour to 4 roentgens per hour fractionated radiation. The animals were examined for cataracts, increased incidence of leukemia, increased sterility, and the shortening of life-span. No demonstrable severe biological damage was observed. In a group of several hundred exposed to fractionated doses of from 15 to 200 roentgens over various time intervals, no evidence of decrement of psychomotor performance or clinical manifestations suggestive of biological damage was observed. (C.H.)

11475
Brookhaven National Lab., Upton, N. Y.
BETA RADIATION SKIN LESIONS (BETA BURNS) FROM FALLOUT RADIATIONS. STATEMENT OF DR. VICTOR BOND. p.373-89 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

The nature and extent of skin damage which may result from exposure to large amounts of high-level radioactive fall-out are discussed. Data are reviewed on the clinical findings on the Marshallese accidentally exposed to prompt fall-out from a high yield thermonuclear device in 1954. It was estimated that these individuals received approximately 175 r of penetrating gamma radiation in addition to large doses of beta radiation to the skin. It was not possible to calculate the dose to the skin from beta radiation with any reasonable degree of accuracy. Estimates indicate that the surface of the skin probably received in the order of 5,000 or more rads. Symptoms are described which developed following exposure. The relative importance of beta and gamma radiation in fall-out materials in terms of casualty production is discussed. (C.H.)

11476
[Brookhaven National Lab., Upton, N. Y.].
MEDICAL STATUS OF RONGELAP PEOPLE 5 YEARS AFTER EXPOSURE TO FALLOUT RADIATION. Robert A. Conard. p.430-32 of "Biological and Environmental Effects on Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

A medical survey of the Marshallese people in March 1959, five years after exposure to fall-out radiation, showed that the people had recovered from the acute effects of their radiation exposure and appeared to be generally in good health. Specific findings are summarized. (C.H.)

11477
Brookhaven National Lab., Upton, N. Y.
[HAZARDS FROM INHALED RADIOACTIVE FALL-OUT]. TESTIMONY OF DR. STANTON COHN. p.482-96 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

An individual exposed to an atmosphere contaminated with airborne radioactive particles will be subjected to both external and internal radiation. This contaminated atmosphere, such as is encountered in an area of local fall-out produced by a nuclear detonation, would subject the individual to penetrating gamma and superficial beta radiation both externally and internally. The mechanisms and problems associated with the inhalation of radioactive particles and the ensuing effects upon the respiratory system are discussed. Hazards to other organs of the body from material which is translocated from the lungs are considered briefly. The influence of particle size and solubility of the radioactive particles on uptake is discussed. Both experimental and theoretical data on the deposition of particles within the body are reviewed. (C.H.)

11478
Rochester, N. Y. Univ. School of Medicine and Dentistry.
ACUTE EFFECTS OF INHALATION OF FALLOUT DEBRIS AND ASSOCIATED HAZARDS. J. N. Stannard. p.497-510 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Hazards from inhalation of radioactive dust or other toxic materials produced in a nuclear attack will always be secondary in importance to blast, thermal burns, and external radiation exposures. Under certain conditions they may add enough additional burden to mean the difference between death and survival. Very occasionally inhalation exposure may constitute the chief hazard. The factors involved in inhalation exposure are considered. (C.H.)

11479
Michigan. Univ., Ann Arbor. Medical School.
[GENETIC EFFECTS OF RADIATION FROM LARGE-SCALE NUCLEAR WAR]. STATEMENT OF JAMES V. NEEL. p.610-27 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Sub-

committee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

The genetic effects of radiation from large-scale nuclear war are discussed. The number of mutations and the impact of these mutations on subsequent generations in terms of death, disease, and disability are discussed. A method is presented for estimating the number of mutations produced in a population by radiation and liable to transmission to the next generation. The effects of mutations produced by nuclear warfare on subsequent generations are calculated. An analysis is included of data previously presented by Neel and Schull on the sex of children born to survivors of the atomic bombing of Hiroshima and Nagasaki. (C.H.)

11480

Harvard Univ., Boston. Medical School.

[THE EFFECTS OF NUCLEAR RADIATION ON ANIMALS]. STATEMENT OF BERNARD F. TRUM. p.742-84 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

All domestic animals have been found to have a similar response to total-body irradiation. Few if any die after exposure to 250 r and few survive a dose as high as 1000 r. Slower dose rates or fractionated doses are tolerated better than faster delivered acute doses. Some animals like the swine have a much more rapid recovery rate than others like the burro although there is little difference between the response of the species to an acute exposure. The response of the animal may vary with the quality of radiations, and other things being equal the relative biological effectiveness of x or gamma radiation is related to the linear energy transfer of the photon. The body size of the animal has little to do with survival although the very young or the very old may be more radiosensitive. There is no single clinical reaction for irradiation damage in animals, but all animals usually die or recover within three or four weeks following exposure in the low lethal range. The responses of the blood picture, immune factors, and reproductive system are discussed. Limited experimental evidence and field testing indicate that animals in the path of a fall-out which fail to develop beta burns will have been exposed to less than harmful external radiation, and the radionuclides from that cloud will be practically innocuous to the grazing animals. The effects of total-body exposure to x and gamma radiation on various species are discussed. (C.H.)

11481

Food and Drug Administration, Washington, D. C.

[EFFECTS OF NUCLEAR EXPLOSIONS AND FALL-OUT ON FOODSTUFFS AND CONTAINERS]. STATEMENT OF EDWIN P. LAUG. p.792-5 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

A prognostication concerning the fate of processed foods located close to a megaton target area is presented, based on an extension and extrapolation of the effects noted on foods and containers exposed in the Nevada test series. All foodstuffs and containers would become radioactive through the action of neutrons emitted at the time of the blast. With the exception of phosphorus-32, most of the radioactivity would decay within a few days. The effects of blast and heat on foods and containers are discussed and the potentialities for contamination of the entire food chain by fall-out are considered. (C.H.)

Radiation Sickness

11482

PROTECTION OF THE HEMATOPOIETIC SYSTEM BY PARABIOSIS. Shields Warren, R. N. Chute, and E. M. Farrington (New England Deaconess Hospital, Boston). Lab. Invest. 9, 191-8(1960) Jan.-Feb.

Parabiosis permits rats to survive lethal x-irradiation. This protection is due in part to maintenance of blood cell counts within nearly normal levels. The approximately normal blood cell counts and hematocrit levels are maintained at first by transfer of circulating cells, later by repopulation of the marrow. (auth)

CHEMISTRY

General and Miscellaneous

11483 AERE-R-3183

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SORPTION AND DESORPTION OF IODINE. F. Hudswell, E. Furby, J. G. Simons, and K. L. Wilkinson. Jan. 1960. 18p. BIS.

Adsorption isotherms were measured for various substances for iodine in carbon tetrachloride at 20°C. Sorption of radioiodine by these solids from the gas phase was also measured at 200°C; exchange of the radioiodine with inactive iodine has shown considerable differences in behavior; thermal desorption is not easily accomplished. The results are discussed briefly in terms of radioiodine transport, after an accidental release of activity, to a stack of filters. Copper is an efficient trapping agent for iodine at temperatures below 300°C. (auth)

11484 CEA-1265

France. Commissariat à l'Énergie Atomique, Paris.

PRÉPARATION DU BUTADIENE D_6—1,1,2,3,4,4. (Preparation of Butadiene D_6—1,1,2,3,4,4). L. Pichat and G. Chatelain. 1959. 16p.

A description is given of the preparation of butadiene-D_6 by dehalogenation of perchlorobutadiene by Zn and D_2O in dioxane. (auth)

11485 GEAP-3272

General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.

METAL—WATER REACTIONS. VI. ANALYTICAL FORMULATIONS FOR THE REACTION RATE. Leo F. Epstein. Sept. 30, 1959. 52p. Sept. 30, 1959. Contract AT(04-3)-189. OTS.

The various types of equations relating the extent of reaction between a metal and water vapor are reviewed and discussed. The origin of the most common relation employed, the so-called parabolic rate law, is shown to be the diffusion process through an oxide film on the surface. It is shown that such a law cannot apply to the initial stages of the reaction process, before a coherent film has had a chance to form. For these conditions it is postulated that the rate determining process is the transport of H_2O molecules through the vapor phase. An exact formulation combining these two concepts, and an empirical representation are presented. Other rate laws, such as the cubic, logarithmic, and linear forms are considered. The dependence of the reaction rate on pressure and temperature is analyzed, and it is shown that neither is sufficiently well known to permit more than approximate computation. The effect of geometry on the rate law is discussed by considering plane, cylindrical, and spherical configurations. Equations for determining the rate and extent of reaction when the temperature varies with time are considered. (auth)

11486 HW-30121
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM TRICHLORIDE: PREPARATION BY REACTION WITH PHOSGENE OR CARBON TETRACHLORIDE, AND BOMB REDUCTION TO METAL. W. B. Tolley. Dec. 3, 1953. Decl. Mar. 15, 1960. 28p. Contract W-31-109-Eng-52. OTS.

Batches of plutonium dioxide were chlorinated by reaction with phosgene or carbon tetrachloride. Plutonium trichloride prepared by either method can be reduced to the metal in an hermetically sealed bomb by reaction with calcium. It has been demonstrated that a method for the reduction of plutonium trichloride to the metal without the use of a booster can be developed. Soluble plutonium in slag and crucible waste can be precipitated as the hydroxide and washed essentially free of chloride contamination. The concentrated nitric acid solution from dissolution of plutonium hydroxide and other solids contains less than 75 ppm chloride. Of the materials tested the Hastelloy alloys A, B, and C were found to be the most resistant to phosgene corrosion. The corrosion of these alloys was found to lie between 1×10^{-4} and 2×10^{-4} in. per month at 300°C and between 1×10^{-3} in. per month at 450°C. The logarithm of the corrosion rate plotted as a function of the temperature appears to be linear over the temperature range of 300 to 550°C. Above 550°C the corrosion rate of all materials tested is excessive. (auth)

11487 HW-31211
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE PREPARATION OF PLUTONIUM(IV) AMMONIUM FLUORIDE AND ITS DECOMPOSITION TO PLUTONIUM TETRAFLUORIDE FOR SUBSEQUENT REDUCTION TO METAL. W. B. Tolley. Mar. 16, 1954. Decl. Mar. 15, 1960. 11p. Contract W-31-109-Eng-52. OTS.

An exothermic reaction was shown to take place between low temperature plutonium dioxide and ammonium bifluoride at 50 to 250°C. The reaction goes essentially to completion with the formation of the pink plutonium(IV) ammonium fluoride. This compound can be decomposed at 300°C and the resulting plutonium tetrafluoride dehydrated at 500°C. Analyses showed that plutonium tetrafluoride prepared in this manner is approximately 90% converted from the dioxide. On a twenty gram scale average reduction yields of over 97% can be obtained by reaction with metallic calcium in a hermetically sealed, stationary bomb when a calcium-iodine booster is employed. (auth)

11488 IS-15
Ames Lab., Ames, Iowa.
CHEMISTRY SEMI-ANNUAL SUMMARY RESEARCH REPORT FOR JANUARY—JUNE 1959. Nov. 1959. 74p. Contract W-7405-eng-82. OTS.

Physical and Inorganic Chemistry. Data on quantities of pure rare earths separated during the period are listed and observations on elution sequence are discussed. Solubilities of several rare earth EDTA species are tabulated along with other rare earth compounds. Stability constants of rare-earth chelates with various organic anions are tabulated and results of a study of sulfur isotope separation by ion exchange are given. In rare earth metallurgy, a high-temperature still for separation of pure yttrium metal is described. The apparatus is applicable to other rare earths. Results of rare earth physical property investigations are discussed. Mass spectrometric measurement of oxygen isotopes in a variety of compounds is described along with spectrometric studies of VOF_3 and SnH_4. Studies of chemical bond characteristics are described and abstracts of published papers on these investigations are included. Pyrometallurgy. Developmental activities on an apparatus to determine vapor pressures in metal systems involved in fuel reprocessing cycles are described. Analytical Chemistry. Analytical procedures developed for determination of oxygen in YF_3, Y, and Ti are described. A solvent extraction procedure developed for separating small quantities of Nb from Ta is outlined and abstracts of published papers on determination of vic-dioximes, Pa, complexes of Be and Cu, and on stability orders of transition metal complexes are included. Results of elution studies show that most divalent metals can be separated from trivalent metals in 20 to 50 minutes elution. Spectrochemistry. Description of rare earth spectra studies is given in which about 300 formerly misidentified lines were discovered and corrected. Other work included investigations on infrared spectroscopy and determination of gaseous elements in metals; for which papers were published. Radiochemistry. Continued study of C^{11} produced in the $C^{12}(\gamma,n)C^{11}$ reaction is reported. Studies of activation analysis revealed that this method is only qualitative for carbon and nitrogen in metals. The $Be^9(\gamma,2n)$ reaction is being studied to determine if other reactions give this product and to establish maximum cross sections. X-Ray Chemistry. Parameters obtained in a three dimensional refinement of x-ray data on copper, chlorine, and oxygen atoms are tabulated. In neutron-diffraction studies, published papers on sodium tungsten bronze structure, deuterium positions in lanthanum deuterides, structures of calcium dicarbide and uranium dicarbide, and phosphine are listed with abstracts. (For preceding period see ISC-1116.) (J.R.D.)

11489 KAPL-660
Knolls Atomic Power Lab., Schenectady, N. Y.
STUDIES OF HYDROGEN SORPTION ON PALLADIUM AND THE SEPARATION OF HYDROGEN FROM GAS MIXTURES. R. H. Boice and O. N. Salmon. Feb. 10, 1952. Decl. Mar. 15, 1960. 74p. Contract W-31-109-Eng-52. OTS.

A process was developed for separating hydrogen from such gases as helium and nitrogen by sorption on finely divided palladium at −78 to −100°C. The gas mixture is passed once through a palladium bed which removes more than 99.98% of the hydrogen while the remainder of the gas mixture is pumped through. The hydrogen can be recovered from the bed by evolution at 200 to 350°C. The hydrogen recovered by this process has a purity of better than 99.9%. (auth)

11490 KAPL-1114
Knolls Atomic Power Lab., Schenectady, N. Y.
USE OF SORBENT BEDS FOR TRANSFERRING HYDROGEN GASES. D. H. Ahmann, P. S. Flint, and O. N. Salmon. June 17, 1954. Decl. Mar. 15, 1960. 24p. Contract W-31-109-Eng-52. OTS.

The use of uranium or palladium black beds for transferring hydrogen isotopes has been described. Such beds react quantitatively and rapidly with hydrogen and its isotopes, store large volumes of gas as the solid hydride, and can evolve the gas in a controlled manner to give any reasonable pressure. The uranium bed is somewhat simpler to operate since only heat need be supplied to carry out the pumping cycle, while the palladium must be cooled to approximately −100°C to sorb hydrogen and heated to evolve the gas. The palladium bed is very dependable in operation; it is poisoned only by gases like H_2S and CO and, if poisoned, can be easily reactivated. Uranium is rather easily poisoned by small amounts of air; cycling in hydrogen will reactivate the uncombined uranium but the portion reacted with air will be permanently combined. (auth)

11491 LA-2372

Los Alamos Scientific Lab., N. Mex.

AN INCINERATOR FOR RECOVERY OF ENRICHED URANIUM FROM GRAPHITE POWDER. A. C. Dumrose. Oct. 1959. 26p. Contract W-7405-eng-36. OTS.

Uranium-loaded graphite fines, mostly −100 mesh, are incinerated by simultaneous impingement of several oxygen streams on the surface of the dry charge in a cylindrical, water-jacketed, stainless steel burning chamber with an 8 in. ID. The oxygen distribution head automatically follows the falling surface of the burning graphite as the charge is consumed. Combustion rates of better than 3 lb per hour of powder are attained. The residue from incineration is leached with nitric acid. Uranium peroxide is precipitated directly from the resulting nitrate solution. Two successive precipitations produce product of good purity without a preliminary solvent extraction of the leach solution. (auth)

11492 NP-8452

Minnesota. Univ., Minneapolis. Inst. of Tech.

ON THE KINETICS AND MECHANISM OF PRECIPITATION OF LITHIUM FROM GERMANIUM. Technical Report No. 1. J. R. Carter, Jr. and R. A. Swalin. Nov. 25, 1959. 31p. Contract Nonr-710(27).

The kinetics of precipitation of lithium from germanium was investigated, and variables such as crystal source, pre-annealing treatments prior to the introduction of lithium, and the effects of oxygen and copper additions were studied. The precipitation process can be described by the expression $\log C/C_0 = \exp [-(t/\tau)^n]$. Upon saturation at elevated temperatures, (about 425°C), n is found to be 3/2 for the first part of the process and 1 for the later stages, in agreement with the theory for the growth of precipitate particles proposed by Ham. Upon saturation at low temperatures, however, n is found to be 1/2. It is suggested that this results from the non-uniform distribution of lithium in the crystal prior to precipitation. Nucleus number densities varying by orders of magnitude were obtained from different crystals. It was found that a pre-annealing treatment at 900°C was sufficient to increase the nuclei number densities for all crystals and the differences tend to disappear upon the pre-annealing treatment. Doping with oxygen tended to increase very markedly the number density of nuclei whereas doping with small amounts of copper (several orders of magnitude less than lithium present) decreased the number density of nuclei by about an order of magnitude. Interpretation of these results suggest that an impurity probably GeO_2 is catalyzing the precipitation process. The results of this work do not support the theory of Morin and Reiss that a critically sized nucleus for precipitation consists of an interstitial lithium−vacancy pair. (auth)

11493 NP-8508

Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.

SYNTHESIS OF SEMI-INORGANIC FLUORINE POLYMERS. Quarterly Progress Report No. 6 [for] December 1, 1959 through February 29, 1960. Henry C. Brown. 28p. Contract AF33(616)-5616.

Further studies of the mechanism of the deammoniation of perfluoroalkylamidines to form *tris* perfluoroalkyl-*sym*-triazines have been carried out. The first step in this mechanism, the bimolecular elimination of one mole of ammonia to give the perfluoroalkyl imidine, has been previously described; the present work shows that the second step involves a partial decomposition of the imidine to perfluoroalkyl nitrile. Successive steps and equilibria involved are proposed. Cotrimerization of perfluoroalkyl nitriles and benzonitrile has been shown to occur and 2,4 *bis*(trifluoromethyl)-6-phenyl-1,3,5-triazine has been isolated and identified. (For preceding period see NP-8206.) (auth)

11494 NP-8514

Wyandotte Chemicals Corp., Wyandotte, Mich.

THE SYNTHESIS AND EVALUATION OF NEW BASE STOCK FLUIDS FOR GAS TURBINE APPLICATION. Quarterly Progress Report No. 2 Covering Period December 1, 1959 to February 29, 1960. John D. Behun, Peter T. Kan, and Patricia A. Gibson. Mar. 1, 1960. 93p. Project No. 9(2-3044). Contract AF33(616)-6749.

Progress is reported on the synthesis of new pyrazine derivatives for evaluation as gas turbine lubricants. The preparation of a variety of intermediates and the examination of some of their physical and chemical properties are described. (For preceding period see NP-8226.) (auth)

11495 NYO-2596

Consolidation Coal Co. Research and Development Div., Library, Penna.

UTILIZATION OF RADIOACTIVE ISOTOPES IN COAL PROCESS RESEARCH. Quarterly Technical Status Report No. 4 [for] December 1, 1959−February 29, 1960. P. M. Yavorsky and E. Gorin. Mar. 15, 1960. 29p. Contract AT(30-1)-2350. OTS.

A series of narrow boiling fractions of coal hydrogenation oil were tagged by the Wilzbach technique. The amount of radiolysis damage was determined and found to be quite low for five of the six cuts. One cut showed severe radiation damage. Indications are that this particular fraction had quite a different chemical structure than the others. The studies on model compounds were completed with the tagging of dihydro phenanthrene. Its behavior was quite similar to the coal hydrogenation oil of comparable boiling range. Mixing studies were completed on the rate of segregation of various size coal particles injected, as radioactive tracers, into a uniform size fluidized bed. Diffusion or self-mixing studies were also completed by similar tracing of various size coal particles into fluidized beds of the same size. Fluidized bed expansion studies were carried out as a function of coal particle size, vehicle velocity, and viscosity. The bed interface was located by scanning the column containing a uniformly tagged fluidized bed with a scintillation counter. The results were correlated by the method of Richardson and Zaki. (auth)

11496 NYO-7743

New York Univ., [New York].

ELECTRON SPIN RESONANCE SPECTRA OF MOLTEN SALTS. Technical Progress Report. Maret Kukk and Benson R. Sundheim. Jan. 15, 1960. 50p. Contract AT(30-1)-1938. OTS.

A description of design and construction of special apparatus for use in connection with electron spin resonance measurements of molten salts is presented. Data obtained in electron paramagnetic resonance measurements are included for several salt systems. (J.R.D.)

11497 ORNL-2791
Oak Ridge National Lab., Tenn.
CALCULATION OF SUSPENSION PEPTIZATION. F. H. Sweeton. Apr. 5, 1960. 131p. Contract W-7405-eng-26. OTS.

Existing theories of flocculation, particle repulsion due to Gouy-Chapman double layers, and particle attraction resulting from London—Van der Waals forces were combined to help understand the flocculation characteristics of ThO_2 suspensions. The potential energy due to the combined repulsion and attraction of two spherical particles was calculated for temperatures between 25 and 300°C, particle radii between 50 and 3200 Å, electrolyte valences of 1 and 2, electrolyte concentrations between 10^{-5} and 10^{-3} M, and surface potentials corresponding to surface ionic energies of between 2 and 10 kT units. Flocculation rate calculations indicate that the surface potential required for a particular degree of stability is lowest at low temperatures, large particle radii, low electrolyte valence, low electrolyte concentration, and low suspension concentration. (auth)

11498 RISLEY-8111D
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
THE PURIFICATION OF URANIUM HEXAFLUORIDE BY DISTILLATION AND ADDITIONAL DATA ON THE DISTILLATION OF OTHER CORROSIVE SUBSTANCES. J. F. Ellis and L. H. Brooks. Nov. 1954. 18p. (DDC/P-116D; RB/R-111D).

A method is described for purifying UF_6 from a ternary mixture with ClF_3 and HF by fractional distillation. The results of distilling various binary mixtures of UF_6 with ClF_3, HF, Br, BrF_3, and BrF_5 are presented. Complete separation was attained in the UF_6-ClF_3 and UF_6-BF_3 mixtures. (C.J.G.)

11499 TID-5657
Michigan State Univ., East Lansing.
SPECTROPHOTOMETRIC INVESTIGATIONS OF ALKALI METALS IN LIQUID AMMONIA (thesis). Robert C. Douthit. 1959. 115p. Contract [AT(11-1)-312]. OTS.

The absorption spectra of dilute solutions of Na and K in the liquid NH_3 were obtained as a function of concentration and temperature. The line shapes for the absorption curves were found to be identical and independent of concentration for both Na and K solutions. With an increase in temperature the absorption curve is shifted to lower energies. These results indicate that the absorption process in the near infrared involves the excitation of an electron in a cavity to a higher energy state and is the same for dilute solutions of both metals. (W.L.H.)

11500 UCRL-3515
California. Univ., Berkeley. Radiation Lab.
STABILITY CONSTANTS OF ALPHAHYDROXYISOBUTYRIC ACID COMPLEXES WITH ACTINIDE ELEMENTS. B. Graus Odenheimer and G. R. Choppin. Sept. 26, 1956. 23p. Contract W-7405-eng-48. OTS.

The stability constants of curium and americium alpha hydroxyisobutyrate complexes were determined by means of ion exchange equilibrium measurements on Dowex-50 four percent resin in the ammonium form. The values obtained for curium alpha hydroxyisobutyrate are: $K_1 = 290$, ${}_{p}K_1 = 2.46$; $K_2 = 93$, ${}_{p}K_2 = 1.97$; and $K_3 = 9$, ${}_{p}K_3 = 0.95$. The value for K_1 is probably good to within 10 percent, for K_2 to within 40 percent and for K_3 to within a factor of 2. The total ${}_{p}K = {}_{p}K_1 + {}_{p}K_2 + {}_{p}K_3 = 5.38$. For americium alpha hydroxyisobutyrate, only the first stability constant was determined. The value for this constant is $K_1 = 527$, ${}_{p}K_1 = 2.72$. (auth)

11501 UCRL-9025
California. Univ., Berkeley. Lawrence Radiation Lab.
CHEMICAL PROPERTIES OF ASTATINE (thesis). Evan H. Appelman. Jan. 1960. 113p. Contract W-7405-eng-48. OTS.

A systematic study of the behavior of astatine as a function of the emf of an acid aqueous solution was carried out. This study confirmed the existence of the (−1), (0), and (+5) oxidation states, and of at least one intermediate positive state. A potential diagram for acidic astatine solutions was proposed. No evidence for a (+7) state was found. Iodine was used as a nonisotopic carrier to fix the identity of the (0) state as AtI. The distribution of astatine between aqueous solutions and carbon tetrachloride in the presence of other halogens and halide ions was investigated quantitatively, and evidence for the species AtI, AtI_2^-, $AtIBr^-$, $AtICl^-$, AtBr, $AtBr_2^-$, and $AtCl_2^-$ was noted. The equilibrium constants relating these species were determined. In connection with these studies the distribution of IBr between CCl_4 and aqueous bromide solutions was accurately determined. (auth)

11502 USNRDL-TR-397
Naval Radiological Defense Lab., San Francisco.
A TWO RECORDER INTEGRATOR-READOUT SYSTEM FOR GAS–LIQUID CHROMATOGRAPHY. K. L. Jackson and C. Entenman. Feb. 9, 1960. 24p.

Details of construction and method of operation of an automatic two recorder integration-readout system for gas-liquid chromatography are presented. The apparatus utilizes two recorders to plot data received from the detector. One recorder plots a fraction of the signal seen by the other recorder which, in effect, approximates an increase in recorder chart width. This allows a greater size range of sample components to be handled in a single chromatographic determination than is possible when only one recorder is used. The area under each peak on each recorder is determined by integration as the data are plotted by the recorders. The pulsed signals obtained from the integrators are stored on one of five registers available to each recorder or on one of ten registers when a single recorder is used. Advance of the signal from one register to the next and clearing of registers is automatically performed as each peak is completed. Data are presented which indicate the precision of the apparatus. (auth)

11503 WADC-TN-57-309
Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.
CALCULATION OF DETONATION PARAMETERS FOR GASEOUS MIXTURES. Bernard T. Wolfson and Robert G. Dunn. May 1959. Project title: RESEARCH AND COMBUSTION KINETICS. 96p. (AD-131024). OTS.

A simplified and straightforward yet precise method for the calculation of all detonation parameters for gaseous mixtures is presented. The equations upon which the calculation procedure is based were derived directly from the conservation equations without approximations and involve only nondimensional quantities. The use of the method of calculation developed is illustrated by means of sample calculations. The agreement between values calculated by this method and experimental values is quite satisfactory. The calculation method developed is readily adaptable to computations by automatic computing machines as well as by manually-operated machines. (auth)

11504 WADC-TR-55-221(Pt.VI)
Hooker Chemical Corp., Niagara Falls, N. Y.
FLUORINE-CONTAINING CONDENSATION POLYMERS AND RESINS. [Period covered]: February 1, 1959 to January 1960. David Knutson, John J. Kolano, John E. Wier, and Edward V. Gouinlock. Feb. 1959. 69p. Project title: NON-METALLIC AND COMPOSITE MATERIALS. Task title: NEW CHEMICAL AND METHODS. Contract AF33(616)-5548.

The two principal objectives of this research are to determine the effect of fluorine and fluorine content on the thermal and oxidative stability of polyester laminating resins; and to investigate the preparation of perfluoroglutaronitrile, perfluoroadiponitrile, the corresponding imidine and amidine, and rigid polymers derived therefrom. Polyesters have been synthesized from fluorinated glycols and the corresponding hydrocarbon glycols. Laminates prepared from these polyesters have been aged at elevated temperatures and their physical properties measured before and after aging. In general, the fluorinated polyester laminates exhibit much better retention of physical properties than their hydrocarbon analogs. A description is given of synthetic work directed toward the preparation of fluorine-containing compounds used in the preparation of polyesters and as cross-linking monomers. The preparation and polymerization of perfluoroglutaronitrile is described. The polymerization of perfluoroglutarimidine and perfluoroadipamidine has been investigated. (auth)

11505 WADC-TR-59-427
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
CONFERENCE ON HIGH TEMPERATURE POLYMER AND FLUID RESEARCH. Oct. 1959. 491p. Project No. 7340.

This report is a collection of papers presented at the Materials Laboratory, WADC Conference on "High Temperature Polymer and Fluid Research," held in Dayton, Ohio, May 26-28, 1959.

A compilation of papers given at the conference on "High Temperature Polymer and Fluid Research" is presented. The agenda included discussions of polymers containing M-O-M bonds, silicon-containing materials, novel polymers and polymerization techniques, inorganic polymers and a session on general interest. (auth)

11506 WAL-TR-825-5/1
Watertown Arsenal Lab., Mass.
CRYSTALLOGRAPHIC AND MICROSTRUCTURAL CHANGES OCCURRING DURING THE GRAPHITIZATION OF A PETROLEUM COKE (thesis). Aram Tarpinian. Jan. 1960. 45p. DA Project No. 5B93-32-004. OTS.

Submitted to the Massachusetts Inst. of Tech., Sept. 1959.

An analysis is made of the growth kinetics of carbon crystallites in a Gulf Coast crude petroleum coke. In the range of 2000 to 2500°C an activation energy of 90 to 120 K cal/mole was determined for growth parallel to the c-axis; from 2500 to 2800°C a lower activation energy of 20 to 30 K cal/mole was observed. Cathodic etching techniques were utilized to prepare powdered coke specimens for microstructural examination. Significant changes in microstructure were observed at approximately the same temperature range (2400 to 2500°C) in which the activation energy for crystallite growth changed to the lower value. (auth)

11507 AEC-tr-3706
ON THE INTERCOMBINATION SPECTRA OF COMPLEXES OF A TRANSITION METAL. (Über Interkombinationsspektren von Komplexionen der Übergangsmetalle). H. Hartmann and H. I. Schlafer. Translated for Oak Ridge National Lab. from Rec. trav. chim. 75, 648-57(1956). 18p. JCL.

Theories concerning the intercombination spectra of complexes of a transition metal are discussed. The term systems of central ions of these complexes are described. The results of quantum-mechanical assumptions for the term systems of Ni^{2+} with a tetrahedral and quadratic planar orientation of the ligands are reported. The intercombination spectra of Mn^{2+} and Fe^{3+} aqueous complexes were studied. Theoretical term systems of these complexes are given. A general theory is presented which explains that the intensities of numerous bands observed in the long-wave portion of the spectrum are weaker in extinction by a factor of 100 than the bands observed in complexes in the same spectral range. (C.J.G.)

11508 AEC-tr-4013
THERMODYNAMIC PROPERTIES OF MERCURY COMPOUNDS. P. G. Maslov. Translated for Los Alamos Scientific Lab. from Izvest. Vysshykh Ucheb. Zavedeniĭ, Khim. i Khim. Teknol. No. 3, 335-9(1959). 8p. JCL or LC.

Approximate general formulas were derived to determine heats of formation and, to a certain extent, free energies, logarithms of chemical equilibrium constants, entropy, and heat content for a number of families of compounds containing Hg in the solid phase at 25°C. Using the formulas, the thermodynamic properties of a group of compounds containing mercury were determined. (W.L.H.)

11509 AEC-tr-4026
OPTICAL METHOD FOR INSTANTANEOUS MEASUREMENT OF THE TEMPERATURE OF FLAMES. A. Moutet, C. Veret, and L. Nadaud. Translated for Los Alamos Scientific Lab. from Recherche aéronaut. (Paris), No. 68, 9-19(1959). 25p. JCL.

A method of flame temperature measurement based on reversal of spectral lines is presented. An electro-optical system is used for pick-up and recording. One method for isolating the flame radiations is described as a classical monochromator and an alternate method involves the use of an interference filter designed for the purpose. The complexity of the measurement is pointed out, and it is concluded that monochromatic optical procedures with short response times make possible a more detailed study of combustion because of the ease in following the fluctuations that exist in all high-velocity chamber and flows. (J.R.D.)

11510 AEC-tr-4028
DISPROPORTIONATION OF AMERICIUM(V). A. A. Zaitsev, V. N. Kosyakov, A. G. Rykov, Yu. P. Sobolev, and G. N. Yakovlev. Translated by Helen J. Chick and James S. Coleman (Los Alamos Scientific Lab.) from report NP-7518. 21p. JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 15145.

11511 AEC-tr-4032
AN X-RAY EXAMINATION OF THE CRYSTAL STRUCTURE OF $NaAu(CN)_2$. E. A. Shugam and G. S. Zhdanov. Translated by F. H. Kruse, Helen Chick, and Nonna M. Shaw (Los Alamos Scientific Lab. and Univ. of New Mexico) from Trudy Inst. Krist. Akad. Nauk S.S.S.R. 4, 179-84(1948). 10p. JCL or LC.

An x-ray-diffraction analysis of $NaAu(CN)_2$ revealed a hexagonal cell containing 6 molecules with space group $D_{3}^{2}d$, a = 7.2 A, and c = 17.8 A. The $Au(CN)_2^-$ ion was found to have linear configuration. It was shown that $NaAu(CN)_2$ is isomorphous with $KAg(CN)_2$. (C.J.G.)

11512 AEC-tr-4034

STRUCTURE OF THE HEXAFLUOROMETALLATES(III). Hans Bode and Ernst Voss. Translated by F. H. Kruse and Gretchen Riese (Los Alamos Scientific Lab.) from Z. anorg. u. allgem. Chem. 290, 1-16(1957). 21p. JCL.

Compounds with the formula $Me^I_3XF_6$ crystallize according to various structure types, which are distinguished from each other only by the arrangement of the octahedral XF_6 structure groups. The $(NH_4)_3FeF_6$ type can be regarded as the basic type of this class of compounds. All other structures can be deduced from it. (auth)

11513 CEA-tr-R-729

DÉTERMINATION DE LA CONSTITUTION ET DES CONSTANTES DE DISSOCIATION DES IONS COMPLEXES OXALATES DU PLUTONIUM. VI. (Determination of the Constitution and Dissociation Constants of Complex Ions of Plutonium(VI) Oxalates). A. D. Gel'man (Guel'maii), L. E. Drabkina (Dravkina), and A. I. (J.) Moskvin. Translated into French from Zhur. Neorg. Khim. 3, 1546-50 (1958). 10p.

The quantity of plutonyl oxalate dissolved in a mixture of nitric acid and ammonium oxalate solutions was determined as a function of the variation of the concentration of the ammonium oxalate for concentrations between 0 and 0.4 mole/l. It was proved that in a given solution Pu(VI) is essentially in the form of the complex ions $[PuO_2C_2O_4]^0$ and $[PuO_2(C_2O_4)_2]^{2-}$ with the dissociation constants equal to 2.2×10^{-7} and 3.4×10^{-12}. (tr-auth)

11514 IGIS-65(RD/R)

STEP-WISE COUNTER-CURRENT METHOD OF CONTACTING FINE-GRAINED SOLID MATERIALS WITH GASES AND VAPOURS IN HETEROGENEOUS CHEMICAL PROCESSES. D. I. Orochko, T. Kh. Melik-Akhnazarov, and G. N. Poluboiarinov. Translated by L. H. Sinclair (U.K.A.E.A., Risley) from Khim. i Tekhnol. Topliv i Masel 2, No. 12, 1-12(1957). 19p.

Characteristics of currently used fluidized beds for promoting chemical reactions are described. It is noted that these reactors show many limitations due to inter-reactor circulation of reagents. The greater efficiency of a step-wise counter-current method of contacting is illustrated by its application to four typical heterogeneous processes. Description of the method and conclusions are included. (J.R.D.)

11515 IGIS-66(RD/R)

STEP-WISE COUNTER-CURRENT CONTACT APPARATUS WITH FLUIDIZED BED OF FINE-GRAINED MATERIALS. D. I. Orochko, T. Kh. Melik-Akhnazarov, and G. N. Poluboiarinov. Translated by L. H. Sinclair (U.K.A.E.A., Risley) from Khim. i Tekhnol. Topliv i Masel 3, No. 2, 22-8(1958). 10p.

A review of plants and component construction for contacting apparatus as described in the literature is presented. The possibility of fundamental improvement in construction of step-wise counter-current contacting apparatus with fluidized beds of pseudo-liquid material has been demonstrated. Details of such apparatus are given, indicating its technological advantages over the customary apparatus with a common fluidized bed. (J.R.D.)

11516 RAE-LIB-Trans-801

THE RELATION BETWEEN THE RATE OF THE CATHODIC HYDROGEN-EVOLUTION REACTION AND THE ADSORPTION ENTHALPY OF ATOMIC HYDROGEN ON VARIOUS METALS. (Ueber den Zusammenhang Zwischen dem Mechanismus der Elektrolytischen Wasserstoffabscheidung und der Adsorptionsenergie des Atomaren Wasserstoffs an Verschiedenen Metallen). H. Gerischer. Translated by A. S. McKie (Royal Aircraft Establishment) from Z. physik. Chem. (Frankfurt) [N.S.] 8, 137-53(1956). 14p. (AD-216068)

The influence of atomic hydrogen adsorption energy on the various reactions which can take part in the reaction scheme for cathodic hydrogen evolution is discussed. Theoretical analysis shows that on metals with a low adsorption energy for H atoms the reaction scheme involves a discharge reaction as the primary step followed by an electrochemical reaction leading to hydrogen evolution, the primary reaction being rate-determining. The first statement holds good for intermediate current densities of the order of mA/cm^2. On metals having an adsorption energy for H atoms above a critical value, the electrochemical or the catalytic recombination reactions are rate-determining. An exact statement of the relation between these parallel reactions may not be derived from the present simplified analysis. Nevertheless it is shown that the recombination reaction is to be expected in the reaction-scheme only in the region of intermediate adsorption energies, whereas with very large adsorption energies the electrochemical reaction, which is once more favored, should be followed. (auth)

11517

THE RADIOACTIVITY OF THORIUM AND URANIUM COMPOUNDS OF CARBOXYMETHYCELLULOSE. N. Asandei, Gh. Vasiliu, and Cr. Simionescu (Rumanian Academy, Iasi Branch). Acad. rep. populare Romîne, Fililia Iaşi, Ştudii cercetări ştiinţ. Chim. 8, 201-10(1957). (Translated from Referat. Zhur. Khim. No. 6, 1959, abstract No. 22002)

For investigating the structure of cellulose and its derivatives, a method was developed for determining the degree of replacement of celluloseglycol acid by means of the utilization of the natural radioactive properties of thorium and uranium compounds of carboxymethylcellulose. Also, an x-ray analysis was conducted of Ag, Al, Cu, Fe, Th, and U in salts of carboxymethylcellulose.

11518

MOLTEN SALTS. Conference Held by the New York Academy of Sciences, April 13-15, 1959. Otto v. St. Whitelock, ed. Ann. N. Y. Acad. Sci. 79, 761-1098(1960) Jan. 30.

Twenty-two papers are included. Separate abstracts have been prepared for each paper. (W.L.H.)

11519

X-RAY AND NEUTRON DIFFRACTION STUDIES OF MOLTEN ALKALI HALIDES. H. A. Levy, P. A. Agron, M. A. Bredig, and M. D. Danford (Oak Ridge National Lab., Tenn.). Ann. N. Y. Acad. Sci. 79, 762-80(1960) Jan. 30.

Eight molten alkali halide salts were studied by x-ray diffraction, and 3 of them also by neutron diffraction. Radial distribution functions clearly show the first 2 coordination shells, although not completely resolved. The first shell is a band of about 0.5 A half-width, with the most frequent interatomic distance being smaller than that in the solid at room temperature. It corresponds to an average coordination of about 4 to 5 neighboring ions. Neutron patterns confirm that the first coordination shell involves unlike ions. The second shell, which corresponds to 7 or more ion neighbors, is less well defined. This information, together with the density decrease on melting, indicates that the melts have quite open structures with a wide variety of individual ion coordinations. (auth)

11520

PARTITION FUNCTIONS FOR NORMAL LIQUIDS AND MOLTEN SALTS. G. E. Blomgren (National Carbon Co., Cleveland). Ann. N. Y. Acad. Sci. 79, 781-9(1960) Jan. 30.

The partition function for liquids, developed by Eyring et al., was applied to the absolute-rate theory expression for viscosity for liquid argon, methane, and nitrogen with very satisfactory results. It is held that the agreement obtained lends support to the validity of the mechanism for viscosity. The partition function was also extended to the case of molten salts, and reasonable agreement with experiment is obtained for the molar volume of molten KCl. (auth)

11521

STRUCTURE OF MOLTEN MERCURIC HALIDES. George J. Janz and James D. E. McIntyre (Rensselaer Polytechnic Inst., Troy, N. Y.). Ann. N. Y. Acad. Sci. 79, 790-802(1960) Jan. 30.

The results of investigations on the structure and constitution of the mercuric halides in the molten state are reported. Considered are the physical properties and the conditions necessary to form associated groups (complex ions and molecules), with particular reference to mercuric bromide. (W.L.H.)

11522

SOME THERMODYNAMIC ASPECTS OF MOLTEN SALTS: HALIDES OF URANIUM, ZIRCONIUM, THORIUM, AND CERIUM IN ALKALI HALIDE EUTECTICS. D. Inman, G. J. Hills, L. Young, and J. O'M. Bockris (Imperial Coll., London and Univ. of Pennsylvania, Philadelphia). Ann. N. Y. Acad. Sci. 79, 803-29(1960) Jan. 30.

The technique of thermodynamic studies by means of galvanic cells and the processes occurring at working electrodes is described. Measurement of the dependence of the reversible, or stationary, electrode upon concentration, temperature, current density, and time are described for the systems U/UCl_3; $Zr/ZrCl_4$; $Th/ThCl_4$; and $Ce/CeCl_3$. (W.L.H.)

11523

ACTIVITIES IN MOLTEN SALT MIXTURES OF POTASSIUM-LITHIUM-HALIDE MIXTURES: A PRELIMINARY REPORT. E. Aukrust, B. Björge, H. Flood, and T. Førland (Norwegian Inst. of Tech., Trondheim). Ann. N. Y. Acad. Sci. 79, 830-7(1960) Jan. 30.

Activities in the molten salt mixtures LiF-KF, LiCl-KCl, and LiBr-KBr were determined from their phase diagrams. (W.L.H.)

11524

A QUASI-LATTICE MODEL OF MOLTEN RECIPROCAL SALT SYSTEMS. Milton Blander (Oak Ridge National Lab., Tenn.) and Jerry Braunstein (Univ. of Maine, Orono). Ann. N. Y. Acad. Sci. 79, 838-52(1960) Jan. 30.

The activity coefficients γ_{ad} of the component AD were calculated theoretically, using two different approximations based on the lattice model for the molten reciprocal salt system A^+, B^+, C^-, D^-. The activity coefficients of $AgNO_3$ in the two molten solvents KNO_3 and $NaNO_3$ dilute in Ag^+ and Cl^- ions were measured in an electromotive-force (emf) cell. The activity coefficients of $AgNO_3$, γ_{AgNO_3}, are much lower in the KNO_3 solvent than in the $NaNO_3$ solved at the same temperature and at the same concentrations of Ag^+ and Cl^- ions. The differences between the behavior in the two solvents can be correlated with the relative sizes of the K^+ and Na^+ ions and with the relative effects of the fields of these two solvent cations on the energy of interaction of an Ag^+-Cl^- pair. (W.L.H.)

11525

SOLUBILITIES OF TITANIUM TETRACHLORIDE IN MIXTURES OF POTASSIUM CHLORIDE AND SODIUM CHLORIDE, AND THE ELECTRODE POTENTIALS OF THE TITANIUM CHLORIDES IN 1/1 (MOLE) KCl-NaCl SOLUTIONS. S. N. Flengas (Dept. of Mines and Technical Surveys, Ottawa). Ann. N. Y. Acad. Sci. 79, 853-72(1960) Jan. 30.

The solubilities of $TiCl_4$ in mixtures of KCl and NaCl at various temperatures were investigated, using a quartz spring balance. It was found that $TiCl_4$ vapor reacted with KCl to form the compound K_2TiCl_6. Some of the physical properties of this compound were investigated. Using a Ag-AgCl reference electrode, the apparent standard electrode potential of the system Ti, $TiCl_{2(KCl + NaCl)}$, and the apparent standard redox potentials of the systems $TiCl_2$, $TiCl_{3(KCl + NaCl)}$ and $TiCl_3$, $K_2TiCl_{6(KCl + NaCl)}$ were measured at 670°C, and found to be 1.115, 0.910, and 0.350 volts, respectively. From the data, the apparent standard electrode potentials of the system Ti, $TiCl_{3(KCl + NaCl)}$, and Ti, $K_2TiCl_{6(KCl + NaCl)}$ were calculated and found to be 1.046 and 0.697 volts, respectively, at 670°C. (W.L.H.)

11526

FREEZING POINTS OF BINARY NITRATE MELTS. K. J. Macleod and F. E. W. Wetmore (Univ. of Toronto). Ann. N. Y. Acad. Sci. 79, 873-7(1960) Jan. 30.

The freezing points of $AgNO_3-Ba(NO_3)_2$, $AgNO_3-Ca(NO_3)_2$, and $AgNO_3-Mg(NO_3)_2$ melts were determined by letting the temperature fall at an initial rate of ~0.5°C/min. Undercooling was generally less than 0.5°C and the upper-melting point or thaw point was found by heating a mixture of liquid and crystals above the point of complete liquefaction, and extrapolating the segments of the heating curve. With dilute solutions, the freezing point and upper melting point were found to be the same within 0.01°C. The eutectic point of the system $AgNO_3-Ba(NO_3)_2$ was found to be 208.0°C at 0.99 M %. The eutectic point of the system $AgNO_3-Ca(NO_3)_2$ was found to be 193.7°C at 10.1 M %. The eutectic point of the system $AgNO_3-Mg(NO_3)_2$ was estimated to be 159.5°C at 22.1 M %. (W.L.H.)

11527

THERMODYNAMIC PROPERTIES OF SOLUTIONS OF CERIUM CHLORIDE IN MOLTEN ALKALI HALIDES. S. Senderoff, G. W. Mellors, and R. I. Bretz (National Carbon Co., Cleveland). Ann. N. Y. Acad. Sci. 79, 878-96(1960) Jan. 30.

The thermodynamic properties of solutions of $CeCl_3$ in KCl and NaCl were determined over a concentration range extending from pure $CeCl_3$ to 10^{-3} mole fraction. The effects of NaCl and KCl as diluents are compared, and it is found that the $CeCl_3-NaCl$ system is more nearly ideal in its behavior than the $CeCl_3-KCl$ solution. Experimentally determined thermodynamic values for $CeCl_3$ between 800 and 900°C are given. (W.L.H.)

11528

THERMODYNAMICS OF MOLTEN BINARY CHLORIDE MIXTURES CALCULATED FROM THE PHASE DIAGRAMS. Benjamin Chu and James J. Egan (Brookhaven National Lab., Upton, N. Y.). Ann. N. Y. Acad. Sci. 79, 908-18 (1960) Jan. 30.

The excess free energy of mixing of both components is calculated for the binary systems LiCl-KCl, $MgCl_2-KCl$, $CaCl_2-KCl$, $CaCl_2-RbCl$, and $CaCl_2-CsCl$ from existing phase diagrams. The method of Hauffe and Wagner is employed for systems containing intermediate phases along with the conventional equations for freezing-point lowering and the Gibbs-Dahem equation. (W.L.H.)

11529

THE CRYOLITE SITUATION. L. M. Foster (Aluminum Co. of America, New Kensington, Penna.). Ann. N. Y. Acad. Sci. 79, 919-29(1960) Jan. 30.

Information on electric conductivity, transport, melt densities, melt constitution, and vaporization processes in the NaF–AlF_3 system have been considered in an effort to obtain correlation. The simple picture of cryolite dissociating to sodium and aluminum fluorides and these ionizing to Na^+, Al^{3+}, and F^- ions is not acceptable. Dissociation to NaF and $NaAlF_4$ can be correlated to molten densities, cryoscopic lowering, and vaporization processes. Correlation with electric conductivity and transport data also is obtained if the sodium fluoride further is considered to be dimerized partially in the melt. The best information yields the following values: cryolite composition at 1000°C., 65.2% Na_3AlF_6, 13.9% NaF, 20.9% $NaAlF_4$, by weight; vapor pressures of Na_3AlF_6, NaF and $NaAlF_4$ in the ratio 5 : 1 : 30; pure, molten NaF is 31% dimerized at 1000°C.; equivalent, conductances of Na^+ and F^- are 83.8 and 58.7, at the cryolite composition. (auth)

11530

ABSORPTION SPECTRA OF FUSED-SALT SOLUTIONS. G. Pedro Smith and Charles R. Boston (Oak Ridge National Lab., Tenn.). Ann. N. Y. Acad. Sci. 79, 930-40(1960) Jan. 30.

Studies were made of the ultraviolet absorption spectra of the oxy-anions nitrate, chromate, and nitrate in a variety of fused-salt mixtures. (W.L.H.)

11531

ABSORPTION SPECTRA IN MOLTEN SALTS. George Harrington and Benson R. Sundheim (New York Univ., New York). Ann. N. Y. Acad. Sci. 79, 950-70(1960) Jan. 30.

The absorption spectra of metal ions of the first transition series dissolved in molten LiCl–KCl eutectic are given, together with the spectra of some of the ion dissolved in molten KSCN. It is shown that the stoichiometry and geometry of complex ions occurring in these melts can be determined, in most cases, by comparing the spectra with those of crystals or solutions where the configurations of the ion is known and by utilizing the legand field theory. (W.L.H.)

11532

ISOTHERMAL AND ISOPIESTIC DECOMPOSITION OF POTASSIUM PERCHLORATE AND POTASSIUM CHLORATE. Aubrey E. Harvey, Carl J. Wassink, Tommy A. Rodgers, and Kurt H. Stern (Univ. of Arkansas, Fayetteville). Ann. N. Y. Acad. Sci. 79, 971-87(1960) Jan. 30.

Samples of purified potassium perchlorate were decomposed at various constant pressures of air or oxygen and at various constant temperatures from 555 to 590°C. A number of differential thermal analyses of potassium chlorate was made in which the runs were stopped at various temperatures ranging from 330 to about 600°C. The purpose of these studies was to establish a record of the thermal behavior throughout the range from room temperature to 600°C and to determine the relative amounts of products formed at various stages of decomposition. (W.L.H.)

11533

INTERIONIC FRICTION COEFFICIENTS IN MOLTEN SALTS. Richard W. Laity (Princeton Univ., N. J.). Ann. N. Y. Acad. Sci. 79, 997-1022(1960) Jan. 30.

Interionic friction coefficients for a number of pure molten salts were calculated from available data and are summarized in tabular form. The list includes all of those salts for which results of self-diffusion experiments were reported, as well as a number of examples for which only conductivity and density were measured. The effects of 3 experimentally variable conditions on the magnitudes of the friction coefficients are discussed separately; that is, size of the thermodynamic force, temperature, and pressure. A simple exponential relation is shown to describe the temperature dependence of both cation-anion and like-ion coefficients. A criterion for association between the oppositely charged species in pure binary salts, based on the occurrence of negative like-ion friction coefficients, is shown to give evidence for the existence of such association in molten $ZnBr_2$. The interionic friction coefficients for completely dissociated salts are discussed with regard to their possible correlations with the microscopic properties of the ions; that is, charge, size, shape, and mass. A semiquantitative discussion of the friction coefficients in molten salt mixtures is based on the incomplete transport data currently available for a number of systems. Cation-anion friction coefficients are shown to approximate ideal concentration dependence in the $AgNO_3$–$NaNO_3$ system, while such behavior is ruled out by the data for the system LiCl–KCl. Association between ions in the KBr–$AlBr_3$ system is demonstrated by the occurrence of negative coefficients, while the case of KCl–$PbCl_2$ is seen to remain ambiguous in the absence of complete transport data. (auth)

11534

ION MOBILITIES IN PURE FUSED SILVER CHLORIDE. F. R. Duke, A. L. Bowman, E. Wolf, and H. Garfinkel (Iowa State Univ. of Science and Tech., Ames). Ann. N. Y. Acad. Sci. 79, 1023-4(1960) Jan. 30.

Ion mobilities in a number of pure fused salts and salt mixtures were determined, using radiotracers to follow the progress of ions through porous membranes. The work has now been extended to include pure AgCl. (W.L.H.)

11535

REFERENCE ELECTRODES AND OVERVOLTAGE MEASUREMENTS IN MOLTEN SALTS. R. Piontelli (Politecnico, Milan). Ann. N. Y. Acad. Sci. 79, 1025-72(1960) Jan. 30.

Some definitions are given, and the general concept involved in the over-voltage measurements in molten salts is summarized. The problem of the reference electrodes, in view of the overvoltage measurements, is discussed. Some practical solutions are presented. Examples of measurement results are given and discussed briefly. (W.L.H.)

11536

COMPOSITION OF VAPORS IN EQUILIBRIUM WITH SALTS AT HIGH TEMPERATURES. Joseph Berkowitz and William Chupka (Argonne National Lab., Lemont, Ill.). Ann. N. Y. Acad. Sci. 79, 1073-8(1960) Jan. 30.

Techniques of mass spectrometric analysis for obtaining data on the activity of the components of a molten salt, including data on the extent of polymer and compound formation and the binding energies of the molecular bonds involved, are discussed. The use of bismuth metal as a calibrating material for a constant measure of over-all sensitivity of the apparatus and as a comparison substance for the determination of relative heats of vaporization or reaction is described. Methods are reviewed which obviate numerical corrections in analysis of high-temperature vapors, including those analyses in which monomeric and dimeric forms coexist. (C.J.G.)

11537

ELECTROLYSIS OF LIQUID BISMUTH–BISMUTH CHLORIDE MIXTURES. Daniel Cubicciotti (Stanford Research Inst., Menlo Park, Calif.) and Norman L. Lofgren (Chico State Coll., Calif.). Ann. N. Y. Acad. Sci. 79, 1088-98 (1960) Jan. 30.

Electrolytic experiments were performed on bismuth-bismuth chloride melts, saturated with metal, between liquid bismuth electrodes. The R of the quantity of electric current passed to the quantity of bismuth transported through the melt during electrolysis was determined. This R was found to be the same as the average oxidation number for bismuth in the salt phase as calculated from the composition. A consideration of the electrode processes led to an explanation of the equality between the current R and the average oxidation number. (auth)

11538

TECHNETIUM AND ASTATINE CHEMISTRY. Edward Anders (Univ. of Chicago). Ann. Rev. Nuclear Sci. 9, 203-20(1959).

The chemistry of technetium and astatine is reviewed relative to crystal structure, oxidation states, and analytical behavior. (C.J.G.)

11539

SEPARATION OF CARRIER-FREE Pa^{233} FROM THORIUM NITRATE PREPARATIONS IRRADIATED BY THERMAL NEUTRONS. V. I. Spitsyn and M. M. Golutvina. Atomnaya Energ. 8, 117-20(1960) Feb. (In Russian)

Carrier-free Pa^{233} was separated from thorium nitrate solution by adsorption on MnO_2, complexing with cupferron, extraction with amyl acetate, re-extraction with citric acid, and disintegrating the citric acid complex with nitric acid. A satisfactory purification from α and β emitters was achieved. The prepared isotope was identified by its half life. The method can be applied in chemical studies of protactinium and in problems related to protactinium extraction from ores as well as in Pa^{233} separation from irradiated thorium. (tr-auth)

11540

Pu(IV) COPRECIPITATION WITH ORGANIC COPRECIPITANTS. V. I. Kuznetsov and T. G. Akimova. Atomnaya Energ. 8, 148-50(1960) Feb. (In Russian)

A satisfactory coprecipitation of Pu(IV) and separation of all elements except thorium are achieved with butylrhodamine nitrate at $1:1 \times 10^{10}$ Pu(IV) dilution. The precipitation of Ce(IV) is eliminated by the preliminary transition Ce(IV) → Ce(III). The amount of uranium carry-over is reduced by U(IV) → U(VI). Following four precipitations, 80% of the plutonium can be separated with only 0.0025% uranium carry-over from the initial mixture of Pu(IV). With pH ~5 to 7 the method can also be utilized for coprecipitation of Pu(III) in dilute solutions. The selectivity of precipitation in the latter case is worse than with Pu(IV). (R.V.J.)

11541

POLAROGRAPHIC STUDIES ON THE RARE EARTHS. II. EUROPIUM. Seizo Misumi and Yasushi Ide (Kyushu Univ., Fukuoka, Japan). Bull. Chem. Soc. Japan 32, 1159-64 (1959) Nov.

The double reduction waves of pure aquo tripositive europium ion, under various conditions, at the dropping mercury electrode were studied. The effects of the variations in pH, the concentration of europium ions, the anion species of supporting electrolytes, and the concentration of gelatin as maximum suppressor, etc. were examined. The electrode reaction of the first wave was irreversible and one electron reduction, and that of the second wave was the irreversible or quasi reversible two electrons reduction. The half-wave potentials of the first wave and the second wave at pH 2.95 were $(E_1)_{1/2}$: −0.767 V. vs. S.C.E., $(E_2)_{1/2}$: −1.971 V. vs. S.C.E., where concentration of Eu^{3+} ion: 1.104 mM in 0.1 M LiCl and 0.01% gelatin medium. (auth)

11542

DETERMINATION OF THE SOLUBILITY OF THORIUM HYDROXIDE. Shinnosuke Higashi (Shigematsu Lab., Japan). Bull. Inst. Chem. Research, Kyoto Univ. 37, 200-6 (1959) May.

Thorium nitrate solutions of 3×10^{-3} mole were adjusted to 5.5 to 8.0 in pH with sodium hydroxide and then filtered. The amount of thorium in the filtrate was determined by a colorimetric method using o-arsonophenylazo-chromotropic acid as a reagent. The solubility of thorium hydroxide was estimated as follows: pH = 3.75, Th = 4.32 mg/liter, pH = 4.30, Th = 590 μg/liter, pH = 4.70, Th = 347 μg/liter, pH = 5.40, Th = 68.5 μg/liter, pH = 6.05, Th = 43.5 μg/liter, and pH = 7.10, Th = 32.7 μg/liter. Other factors which control the solubility of thorium hydroxide were discussed. (auth)

11543

SOLVENT EXTRACTION OF METAL ACETYLACETONATES. Masayuki Tabushi (Shigematsu Lab., Japan). Bull. Inst. Chem. Research, Kyoto Univ. 37, 252-9(1959) July.

The extraction behaviors of metal acetylacetonates are described. Extraction curves were obtained by shaking the aqueous solution of metal salt, containing 1% acetylacetone and having a various given pH, with 20 ml of chloroform or butyl acetate. Al, Be, Fe^{3+}, Ga, Hf, In, and UO_2 were almost quantitatively extracted with chloroform, and Fe, In, and UO_2 were completely extracted with butyl acetate. Ce, Cu, Pb, Mn, Y, and Zn were extracted incompletely, and Cd, Co, Mg, Ni, and Sr could not be extracted at any pH. Effect of EDTA on the extractions was also investigated. By introducing EDTA, the selectivity of acetylacetone was enhanced. Al and Fe were extracted only a small part, and other metals were not extracted at all, although the extraction of Be and UO_2 were nearly quantitative. From the summarized results, the application of the solvent extraction of metal acetylacetonate to the separation of metals was discussed. (auth)

11544

CHROMATOGRAPHIC SEPARATION OF FRANCIUM FROM CESIUM AND RUBIDIUM. A. K. Lavrukhina, A. A. Pozdnyakov, S. S. Rodin, and L. P. Moskaleva (Vernadski Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 130, 88-9 (1960) Jan. 1. (In Russian)

Effective and rapid separation of Cs, Fr, and Rb was achieved with 5.5 M HCl solution. Depending on the rate of solution flow, the separation was achieved within 30 to 50 min. Separation of Cs and Rb by 0.7 M HCl solution proved possible but required from 4 to 5 hours. (R.V.J.)

11545

DEUTERIUM–HYDROGEN EXCHANGE WHEN SOLID OLEFINS ARE BEING SUBJECTED TO HYDROGENATION BY ATOMIC HYDROGEN AT −196°. A. N. Ponomarev and V. L. Talrose (Inst. of Chemical Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 130, 120-1 (1960) Jan. 1. (In Russian)

The kinetics of deuterium–hydrogen exchange was studied in order to determine the mechanism of hydration. At identical pressures and temperatures the rate of isobutylene hydration was slower than that of propylene. With the temperature of propylene reduced so as to make hydrogen absorption equal for both reactions, it was found that a rapid isotopic exchange takes place along with hydration, and molecules of HD and H_2 appear in the gas phase. A diagram is plotted of the partial pressures of D_2, HD, and H_2 and the total hydrogen pressure in propylene and isobutylene hydration. (R.V.J.)

11546

EXCHANGE OF HYDROGEN ISOTOPES ON PALLADIUM.

G. N. Trusov and N. A. Aladzhalova (Karpov Scientific Research Inst. of Physics and Chemistry). Doklady Akad. Nauk S.S.S.R. 130, 370-3(1960) Jan. 11. (In Russian)

Deuterium and tritium were used in measuring the rate of hydrogen exchange between the adsorption layers in palladium. The experiments followed two variations. $Pd(H)_n + D_2^*O \rightarrow Pd(H)_{n-1} D^* + HDO$ and $Pd(H)_{n-1}T^* + H_2O \rightarrow Pd(H)_n + T^*HO$. The data were used in the correlation of true hydrogen exchange rates with the exchange rates found by the extrapolation of overpotential curves and ionization to the overpotential value at equilibrium. (R.V.J.)

11547

INTRACOMPLEX COMPOUNDS OF HEXAVALENT URANIUM WITH AZOMETHIN DERIVATIVES. V. V. Zelentsov, I. A. Savich, and V. I. Spitsyn. Doklady Akad. Nauk S.S.S.R. 130, 549-51(1960) Jan. 21. (In Russian)

The stereochemistry of intracomplex uranyl compounds with Schiff's basis was analyzed. The complexes were divided into three Schiff groups: those prepared with aromatic o-hydroxyaldehyde and ethylenediamine, with aromatic amine, and with 2-aminopyridine(c). Bases of the disalicitalethylenediamine type are tetrodentate reagents. The analysis indicated the presence of only one molecule of solvent in the uranyl of the first group, the molecule can be separated following prolonged heating at 160 to 180°C; the second group uranyls contain two molecules of solvent which do not separate at 160 to 180° but at 200 to 220°C the whole complex disintegrates. The third group with 2-aminopyridine is more stable and shows tendencies to complex with uranyl ion. Coordinate uranium(VI) saturation was observed in uranyl with azeomethene derivatives of 2-aminopyridine. The phenomenon occurs only if heterocyclic nitrogen is coordinately bonded with the central atom. The coordinate number of U(VI) in these complexes is 8; thus uranium has a variable coordination number according to Schiff reagent properties. (R.V.J.)

11548

A THERMODYNAMIC STUDY OF THE REACTION $UO_2(s) + \frac{1}{2}C(gr) + Cl_2(g) = UOCl_3(s) + \frac{1}{2}CO_2(g)$ BY THE ELECTROMOTIVE FORCE METHOD. M. V. Smirnov, I. F. Nichkov, S. P. Raspopin, and M. V. Perfilev (Electrochemical Inst. of Ural Branch of the Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 130, 581-4(1960) Jan. 21. (In Russian)

Thermodynamic studies carried out by two types of chlorination, $Me_2O_n(t) + (n/2)C(t) + nCl_2 = 2MeCl_n(melt) + (n/2)CO_2(g)$, where the oxide in the melt does not react with the metal chloride in the melt, and $Me_2O_n(t) + (n-2/2)C(t) + (n-2)Cl_2(g) = 2MeOCl_{(n-2)}(t) + (n-2/2)CO_2(g)$, where the oxide and chloride form oxychlorides insoluble in the melt. The experiments show that the method of electromotive forces is applicable to studies of thermodynamic chlorination resulting in oxychlorides. The results are in good agreement with published thermodynamic oxychloride constants, but differ from the entropy values. This is probably the result of the structure of uranium oxychloride. (R.V.J.)

11549

CHLORINATION OF RARE-METAL SILICATES IN A MELT OF ALKALI-METAL CHLORIDES. L. V. Zverev and Z. S. Barsukova (All Union Inst. of Mineral Resources USSR). Doklady Akad. Nauk S.S.S.R. 130, 593-5(1960) Jan. 21. (In Russian)

Chlorination of rare metal silicates in salt melts of NaCl–KCl was studied using specimens of beryllium, beryllium margarite, zirconium, and spodumene and using specimens of silicates without rare metals of albite, kaolin, and quartz at 700 to 950°C. Chlorination curves as functions of temperature are plotted. The most extensive chlorination was observed at 850°C, varying from 90% (for albite) to 97.7% (for margarite). The minerals completely decomposed at 150°C. Quartz chlorination is slower, 31% at 850°C and 42% at 950°C. Beryllium chlorinates 38% at 950°C and 85% at 1300°C. (R.V.J.)

11550

BASIC SALICYLATES OF RARE-EARTH ELEMENTS. V. I. Ermolenko (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 10, 1126-9(1959). (In Ukrainian)

On titrating with a base the perchlorates of lanthanum, neodymium, samarium, gadolinium, ytterbium, and yttrium in the presence of sodium salicylate (Sal), the $LaSal_2^+$ and $LaSal^{2+}$ ions united with hydroxyl ions at lower values of pH than the La^{3+} ions, and form slightly soluble basic salts of the composition $LaSal_2OH$ and $LaSal(OH)_2$. These salts were isolated preparatively and analyzed for lanthanum, neodymium, samarium, and yttrium. The fact that the isolated substances belong to the basic salts and are not intracomplex compounds is shown by the difficulty of their formation (taking the form of a raised pH value of the neutralization section on the potentiometric titration curve) when the free salicylate ion content is greater than the value of the instability constant of formation of $LaSal_3$ molecules from the $LaSal_2^+$ ion. Titration of 1 mole of rare-earth element perchlorate terminated at 2.5—and in the presence of sodium salicylate at 2.0—base equivalents. This indicated a greater stability and constant composition of basic rare-earth salicylates as compared with the basic rare-earth perchlorates. (auth)

11551

RADIOACTIVE ION EXCHANGE SURFACES, VERSATILE RADIATION SOURCES. Albert E. Johnson, Jr., and Alvin S. Blum (Veterans Administration Hospital, Coral Gables, Fla. and Univ. of Miami School of Medicine, Coral Gables, Fla.). Intern. J. Appl. Radiation and Isotopes 7, 327-9(1960) Feb. (In English)

A sheet plastic material was developed which has uniform ion exchange properties restricted to a thin layer of a single surface. With this material it is possible to obtain an infinitely thin source of radioactivity by simply immersing in an appropriate solution of radioactive isotopes. (auth)

11552

THE HEAT CAPACITY AND THERMODYNAMIC FUNCTIONS OF β-URANIUM DEUTERIDE FROM 5 TO 350°K. Bernard M. Abraham, Darrell W. Osborne, Howard E. Flotow, and Robert B. Marcus (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 82, 1064-8(1960) Mar. 5.

The heat capacity of UD_3 was measured in an adiabatic calorimeter from 5 to 350°K. The enthalpy and entropy at 298.15°K calculated from the data are 2577 ± 5 cal $mole^{-1}$ and 17.20 ± 0.03 cal deg^{-1} $mole^{-1}$, respectively. The entropy and free energy of formation for UD_3 at 298.15°K as well as the heat of formation at the absolute zero were calculated from these data and the previously reported heat of formation and have the values −46.76 cal deg^{-1} $mole^{-1}$, −17,080 cal $mole^{-1}$, and −29,000 cal $mole^{-1}$. It was found that the calculated and observed dissociation pressures are not in agreement. A similar discrepancy was found for UH_3 and it was suggested that the source might be a particle size effect in the dissociation pressure measurements or the heat of transition of the α-form of UH_3 to the β-form. These heat capacity data were combined with the reported values for UH_3 to calculate the hydrogen and deuterium vibration frequencies in the compounds. An anomaly in the heat capacity was observed which arises from the transition from the ferromagnetic state to the paramagnetic state. The maximum in the heat capacity is 11.72 cal deg^{-1} $mole^{-1}$ and occurs at 167.6 ± 0.5°K. It was estimated that 1.19 cal deg^{-1} $mole^{-1}$ is the entropy change in the transition which is less than the expected value, R ln 2 = 1.38 cal deg^{-1} $mole^{-1}$, from the Heisenberg theory of ferromagnetism. Measurements of the magnetization of UD_3 do not appear to be in accord with the thermal measurements. (auth)

11553

DEUTERIUM ISOTOPE EFFECTS ON THE ACID HYDROLYSIS RATES OF CHLORO COMPLEXES OF COBALT (III). Ralph G. Pearson, Nancy Charlson Stellwagen, and Fred Basolo (Northwestern Univ., Evanston, Ill.). J. Am. Chem. Soc. 82, 1077-9(1960) Mar. 5.

Deuterium substitution both in the complex and in the solvent slows the rate of acid hydrolysis of chlorocomplexes of cobalt(III). This is similar to what is observed in the solvolysis reactions of organic halides and the same explanations may be used. The isotope effect in the base hydrolysis of $Co(NH_3)_5Cl^{+2}$ is consistent with, but does not prove, an Sn1CB mechanism. (auth)

11554

ION EXCHANGE MEMBRANES FOR USE IN HIGH RADIATION FIELDS. E. J. Tuthill and G. G. Weth (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 82, 1260-1(1960) Mar. 5.

The development of an inexpensive, easily replaced ion exchange membrane for use in high radiation fields is reported. Results from a test using HNO_3 solutions indicate an 84% efficiency for the exchange starting with 0.1 N HNO_3, and 77.6% using 0.3 N HNO_3. The membrane used was a slurry of an organic ion exchange resin. The spent or radiation damaged resin was removed from the ion exchange chamber by flushing with water. (B.O.G.)

11555

RELATIVE HYDROGEN BONDING OF DEUTERIUM. I. IONIZATION CONSTANTS OF MALEIC AND FUMARIC ACIDS AND OF THEIR MONOETHYL ESTERS IN H_2O AND D_2O. George Dahlgren, Jr., and F. A. Long (Cornell Univ., Ithaca, N. Y.). J. Am. Chem. Soc. 82, 1303-8(1960) Mar. 20.

Ionization constants of the acids maleic, fumaric, and their monoethyl esters were determined for the solvents water and 99.5% deuterium oxide using a cell with silver–silver chloride and quinhydrone electrodes. The K^H/K^D ratios for ionization of the esters and for the first and second ionizations of fumaric acid are all close to the value 2.8, in reasonable accord with the Rule and LaMer data for other carboxylic acids. However, for maleic acid the ratios are $K_1^H/K_1^D = 4.2$ and $K_2^H/K_2^D = 2.4$, values which show qualitatively that there is less internal hydrogen bonding for the deuterio bimaleate ion in D_2O than for the hydrogen bimaleate ion in H_2O. Using the procedure of Westheimer and Benfey, the data for maleic acid and its ester permit a semi-quantitative calculation of K_H' and K_D', the ratios of concentrations of the hydrogen bonded and non hydrogen bonded forms of the bimaleate ion in the two solvents. The results are that $K_H' = 6.4$ and $K_D' = 4.0$, again indicating significantly less hydrogen bonding for the deuterio bimaleate ion. (auth)

11556

THE HEAT OF SUBLIMATION AND THE METAL–METAL BOND ENERGY IN $Mn_2(CO)_{10}$. F. A. Cotton and R. R. Monchamp (Massachusetts Inst. of Tech., Cambridge). J. Chem. Soc., 533-6(1960) Feb.

The heat of sublimation of $Mn_2(CO)_{10}$ was estimated from measurements of the temperature dependence of the equilibrium vapor pressure over the solid in the range 102 to 146°C. The result, 15.0 ± 0.5 kcal/mole, was used with other thermochemical data and spectroscopically derived valency-state promotion energies to estimate the strength of the Mn–Mn bond. The result is 34 ± 13 kcal/mole. (auth)

11557

THE INFRARED SPECTRA OF ANHYDROUS TRANSITION-METAL NITRATES. C. C. Addison and B. M. Gatehouse (The University, Nottingham, Eng. and University Coll., London). J. Chem. Soc., 613-16(1960) Feb.

Infrared spectra for the anhydrous nitrates of manganese, copper, zinc, and mercury indicate the presence of covalent metal-nitrate bonds. The anhydrous nitrates of cobalt, silver, cadmium, and lead have spectra characteristic of the nitrate ion. Frequencies for the hydrated nitrates of iron, cobalt, nickel, copper, zinc, and cadmium are given for comparison. Hydrated thorium nitrate exhibits bands characteristic of a co-ordinated nitrato-group. (auth)

11558

CHLORINE EXCHANGE BETWEEN ANTIMONY TRICHLORIDE AND TRIMETHYLCHLOROSILANE IN BENZENE AND HEXANE. PART I. APPARATUS AND TECHNIQUES. A. F. Reid and R. Mills (Australian National Univ., Canberra). J. Chem. Soc., 703-7(1960). Feb.

An apparatus based on vacuum-techniques was developed to study the exchange of chlorine between antimony trichloride and trimethylchlorosilane in benzene and hexane. The method of separation utilizes differential evaporation and is generally applicable to systems containing a volatile and an involatile reactant. Exchange at zero time and the effect of incomplete separation are discussed. (auth)

11559

CHLORINE EXCHANGE BETWEEN ANTIMONY TRICHLORIDE AND TRIMETHYLCHLOROSILANE IN BENZENE AND HEXANE. PART II. KINETICS AND MECHANISM OF EXCHANGE. A. F. Reid and R. Mills (Australian National Univ., Canberra). J. Chem. Soc., 708-12(1960) Feb.

Isotopic halogen exchange occurs between trimethylchlorosilane and, severally, hydrogen chloride and the chlorides of aluminum, antimony, and magnesium, and between the corresponding bromine compounds. The kinetics of the exchange between antimony trichloride and trimethylchlorosilane in hexane were initially of first order with respect to each reactant, and probably so in benzene also. The kinetics are complicated in hexane by formation of a species allowing more rapid exchange with increased time of contact of the reactants, and further complicated in benzene by the interaction of the solvent with antimony trichloride. (auth)

11560

METALLIC NITRATES IN PAPER CHROMATOGRAPHY. VI. SYSTEMS CONTAINING TRI-n-BUTYL PHOSPHATE AND NITRIC ACID. A. S. Kertes and A. Beck (Hebrew Univ., Jerusalem). J. Chromatog. 3, 195-6(1960). (In English)

A continuation is presented of an investigation of the chromatographic behavior of metallic nitrates in tri-n-butyl phosphate. Experiments were carried out varying the technique, the initial concentration of the nitrates and/or the nitric acid, the organic diluent, and the concentration of TBP in the organic diluent. In solutions containing 0 to 5%

TBP all ions had R_F values equal to zero. An increase of TBP above 20% caused R_F values to increase slightly. No other organic diluents used showed any great advantages over purified kerosene, B.P. 210 to 250°. For variations of acid concentration, 1 to 16 M, the R_F values of most ions are not affected. (B.O.G.)

11561

A STUDY OF THE DEUTERIUM ISOTOPE EFFECT IN ANTIOXIDANT ACTIVITY. J. Reid Shelton, E. T. McDonel, and John C. Crano (Case Inst. of Tech., Cleveland). J. Polymer Sci. 42, 289-98(1960) Feb.

Variations of the isotope effect can be brought about by varying the antioxidant concentration, temperature, and the nature of the antioxidant. The antioxidant is thought to be susceptible to direct oxygen attack, which then would produce radicals capable of producing a kinetic chain. Ease of exchange of the labile hydrogen on the antioxidant for deuterium in the presence of an inert organic solvent and heavy water was demonstrated. A very simple procedure was developed for the preparation of deuterated antioxidants. The results support the hydrogen abstraction mechanism for antioxidant activity. (auth)

11562

TRACER TECHNIQUES FOR THE DETERMINATION OF MONOMER REACTIVITY RATIOS. I. A DIRECT COUNTING TECHNIQUE APPLIED TO THE STYRENE–METHACRYLATE COPOLYMERIZATION. Richard H. Wiley and Edwin E. Sale (Univ. of Louisville, Ky.). J. Polymer Sci. 42, 479-89(1960) Feb.

A direct counting technique was evaluated and used for the determination of monomer reactivity ratios. Windowless gas-flow counting of polymer samples plated directly on planchets gave reproducible counting rates and nearly linear self-absorption curves in the 8 to 25 mg/planchet range. Copolymer composition data obtained by radioactivity assay on a series of styrene C^{14}/methyl methacrylate copolymers gave monomer reactivity ratios of $r_1 = 0.48$, $r_2 = 0.46$ at 60° and $r_1 = 0.60$, $r_2 = 0.55$ at 132°. These values are in good agreement with literature values. (auth)

11563

TRACER TECHNIQUES FOR THE DETERMINATION OF MONOMER REACTIVITY RATIOS. II. MONOMER REACTIVITY RATIOS IN COPOLYMERIZATIONS WITH DIVINYL MONOMERS. Richard H. Wiley and Edwin E. Sale (Univ. of Louisville, Ky.). J. Polymer Sci. 42, 491-500(1960) Feb.

Monomer reactivity ratios were determined for styrene ($r_1 = 0.35$) – ethyleneglycol dimethacrylate ($r_2 = 0.65$) and styrene ($r_1 = 0.65$) – m-divinylbenzene ($r_2 = 0.60$), a tracer technique being used to determine the copolymer composition. The data for these divinyl monomers give intersect plots with three different monomer ratios which determine the reactivity ratios. The usual two-component copolymerization equation is modified by the use of $2M_2$ for the M_2 term where M_2 is the mole per cent of the divinyl monomer in the charge. Similar data for p-divinylbenzene do not locate a unique set of reactivity ratios. It is concluded that the copolymerization behavior of symmetrical divinyl monomers in which the vinyl groups do not interact can be evaluated through use of the two-component copolymerization equation. (auth)

11564

EVAPORATOR FOR RADIOACTIVE SUBSTANCES. Wolfgang Bühring and Joachim Heintze (Universität, Heidelberg, Ger.). Nuclear Instr. and Methods 6, 286-7(1960) Feb. (In German)

A vacuum evaporation device is described for the evaporation of radioactive materials. (C.J.G.)

11565

THE ADSORPTION OF URANYL-IONS ON ION EXCHANGERS. Zs. Lévai, J. Mikes, and L. Kovács (Polytechnical Univ., Budapest). Periodica Polytech. (Chem. Eng.) 3, 143-8(1959). (In English)

Dowex-1 and Dowex-2 ion exchangers used in the western countries for uranium-binding were compared with strongly basic anion exchangers produced in the laboratories of the Research Institute for Plastic Materials, Budapest. It was concluded that under laboratory conditions the porous Mykion PA strongly basic exchanger was to be held as the most suitable for binding uranyl-ions from sulfuric acid solutions. The velocity-determining step is the diffusion of the ions in the exchanger phase. (auth)

11566

PREPARATION OF C^{14} LABELED SODIUM OR POTASSIUM CYANIDE. Maria Wolska-Witerowa (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Roczniki Chem. 33, 501-4(1959) (In Polish)

Precise conditions of synthesis of C^{14}-labeled cyanide directly from $BaCO_3$ in a one-step reaction were determined. Average yield was 90%. (auth)

11567

PREPARATION OF $UO_4 \cdot 2H_2O$ DURING SILENT DISCHARGES IN AQUEOUS SOLUTIONS OF URANYL SALTS. Stefan Minc (Univ. of Warsaw) and Andrzej Szymański (Inst. of Physical Chemistry, Polish Academy of Sciences, Warsaw). Roczniki Chem. 33, 551-2(1959) (In Polish and German)

A discharge apparatus is described in which the aqueous solution forms one electrode and a Ni wire is the other electrode with a gap of a few mm. In an experiment, a $UO_2(NO_3)_2$ solution (pH = 3) was used and a discharge was produced at 1,000 v and 0.5 amp at 30 mm Hg. After a time $UO_4 \cdot 2H_2O$ was detected. The amount of $UO_4 \cdot 2H_2O$ was greater than that predicted on the basis of the oxidizing effect of the hydrogen superoxides produced. A mechanism is discussed. (T.R.H.)

11568

INVESTIGATIONS ON ACYLOMONOSES. II. ISOTOPIC EXCHANGE OF ACID RADICALS IN PENTAACETYL-β-D-FRUCTOPYRANOSE. J. Swiderski, Z. Pawlak, and P. Blicharski (Univ. of Warsaw). Roczniki Chem. 33, 739-42(1959). (In Polish)

An isotopic exchange between anhydrous acetic acid labelled with C^{14} in the carboxyl group and pentaacetyl-β-D-fructopyranose was established. In first place the acid radical at the 2 carbon undergoes exchange. In the course of the isotopic exchange the specific rotation of acetylfructose remains unchanged. (auth)

11569

MEAN LIFETIME OF FREE RADICAL CHAINS DETERMINED BY A FLOW TECHNIQUE. R. G. McIntosh, R. L. Eager, and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon). Science 131, 992(1960) Apr. 1.

When radiolysis is induced in chloral hydrate solution flowing through a glass coil wound around a lead brick and irradiated from one side only, the rate of reaction depends on the flow rate. The effect resembles that for intermittent irradiation and makes it possible to estimate the mean lifetime of the free radical chain. (auth)

11570

THE DISSOCIATION PRESSURES OF TITANIUM AND ZIRCONIUM DEUTERIDES AS FUNCTIONS OF COMPOSITION AND TEMPERATURE. J. R. Morton and D. S.

Stark (Services Electronics Research Lab., Baldock, Herts, Eng.). Trans. Faraday Soc. 56, 351-6(1960) Mar.

The equilibrium dissociation pressures of titanium and zirconium deuterides were measured as functions of composition and temperature for atomic ratios (deuterium to metal) between 0.02 and 1.80, in the pressure range 3 to 100 μ (Hg). Graphs of the logarithm of pressure against the reciprocal of temperature give some information on the phases present in the deuteride. (auth)

11571

YTTRIUM HYDRIDE. K. Dialer and B. Frank (Technische Hochschule, Hanover). Z. Naturforsch. 15b, 58(1960) Jan. (In German)

Pure yttrium was reacted with pure hydrogen. The two reacted exothermically at room temperature up to the compound YH_2. Beyond the dihydride, additional hydrogen was taken up only slowly and at increased temperature. The maximum hydrogen content corresponded to the formula $YH_{2.7}$. It was not possible to prepare the trihydride. Debye-Scherrer diagrams showed that the metal atoms in the hydride form a cubic face-centered structure. On the basis of the lattice constant found 5.199 A, YH_2 is assigned to the series of lanthanum dihydrides below gadolinium. (J.S.R.)

11572

SOVIET RESEARCH ON THE LANTHANIDE AND ACTINIDE ELEMENTS, 1949—1957. PART I. BASIC CHEMISTRY. Chemistry Collection Series. (In English Translation). New York, Consultants Bureau, Inc., [1959]. 142p. $15.00.

A review of Russian research between 1949 and 1957 on the chemistry of lanthanide and actinide elements relative to preparation and properties is given. Abstracts have been prepared for 25 of the 26 papers contained which were published. (C.J.G.)

11573

THE SOLUBILITY PRODUCTS OF THE OXALATES OF SOME RARE-EARTH ELEMENTS AND THE DISSOCIATION CONSTANTS OF THEIR COMPLEX SULFATES. I. M. Korenman (Gor'kii State Univ., USSR). p.4-9 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part I. Basic Chemistry.". (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

The solubility products of La, Ce, and Pr oxalates were determined by their solubility in hydrochloric acids and found to give good results with calculations. The solubility of the above rare earth oxalates was of the order 10^{-28}. The dissociation constants of the complex sulfates of La, Ce, Pr, and Nd were determined to be of the order 10^{-3} to 10^{-4}. (C.J.G.)

11574

POTENTIOMETRIC STUDY OF Ce(IV) AND Ce(III) PRECIPITATES BY THE EFFECT OF THE pH OF THE SOLUTION ON THE VALUE OF THE OXIDATION-REDUCTION POTENTIAL OF THE SYSTEM Ce^{4+}/Ce^{3+}. T. N. Bondareva and A. G. Stromberg (A. M. Gor'kii Ural State Univ., USSR). p.10-13 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

The relation of the oxidation-reduction potential of the system Ce^{4+}/Ce^{3+} to the solution pH was studied in the range pH 1 to 9.5. Approximate values of the solubility products of the Ce(III) and Ce(IV) hydroxides were calculated. (C.J.G.)

11575

CAMPHORATES OF SOME RARE EARTH ELEMENTS. Ya. Ya Dodonov and S. B. Pirkes (Saratov State Univ., USSR). p.14-15 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

A method is proposed for preparation of d-camphorates of La, Ce, Pr, and Nd by double decomposition of aqueous solutions of their chlorides with sodium camphorate. It was established that the d-camphorates are moderately soluble with their solubility in the order of Nd, Pr, Ce, La, and Th. The solubility increased with cooling and decreased upon heating. The d-camphorates of the above rare earths were susceptible to hydrolysis. (C.J.G.)

11576

DOUBLE SALTS OF LANTHANUM, CERIUM, PRASEODYMIUM AND NEODYMIUM WITH TRIPHENYLBENZYLPHOSPHONIUM NITRATE. G. V. Medoks (Saratov State Univ., USSR). p.16-17 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

The preparation of the double salts of Ce, La, Ne, and Pr with triphenylbenzylphosphonium nitrate is described. The solubilities of the prepared salts were studied. (C.J.G.)

11577

FREE ENERGY AND HEAT OF DEHYDRATION OF CRYSTAL-HYDRATES OF URANYL NITRATE AND CHLORIDE. A. F. Kapustinskii (Kapustinsky) and L. I. Baranova (Mendeleev Inst. of Tech., USSR). p.18-20 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

The results of tensiometric determinations of the dissociation pressure of uranyl nitrate hexahydrate and uranyl chloride trihydrate at various temperatures are given. From these results the free energy and the thermal effects of the reaction may be derived. (C.J.G.)

11578

THE PREPARATION AND SOME FEATURES OF THORIUM SULFIDES. G. V. Samsonov and N. M. Popova. p.55-60 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6290.

11579

ON SULFIDES OF LANTHANUM. N. P. Zvereva. p.75-6 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 9168.

11580

ON THE COMPLEX COMPOUNDS OF LANTHANUM, CERIUM, PRASEODYMIUM, AND NEODYMIUM WITH THIOUREA. N. N. Sakharova (Chernyskevskii Saratov State Univ., USSR). p.77-9 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part I.

Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10031.

11581

THE REACTION OF CERIUM WITH HYDROGEN. V. I. Mikheeva and M. E. Kost (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). p.80-2 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 675.

11582

DOUBLE SALTS OF LANTHANUM, CERIUM, PRASEODYMIUM, AND NEODYMIUM WITH TRIPHENYLBENZLARSONIUM NITRATE. G. V. Medoks (Saratov State Agricultural Inst., USSR). p. 90-2 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 7179.

11583

PRODUCTION OF THIN LAYERS OF PLUTONIUM, AMERICIUM, AND CURIUM BY ELECTRODEPOSITION. G. N. Yakovlev, P. M. Chulkov, V. B. Dedov, V. N. Kosyakov, and Yu. P. Sobolev. p.214-16 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 8836.

11584

INVESTIGATION OF THE COMPLEX COMPOUNDS OF THORIUM AND AMINOPOLYCARBOXYLIC ACIDS BY MEANS OF HIGH FREQUENCY TITRATION. D. I. Ryabchikov and V. K. Belyaeva (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). p.234-42 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 9236.

11585

RADIOACTIVE TRACERS. (to Esso Research and Engineering Co.). British Patent 831,382. Mar. 30, 1960.

The use of bis-cyclopentadienyl iron-Fe^{59} as tracer in hydrocarbons is described. The material was prepared by adding cyclopentadiene to ethyl magnesium bromide and $Fe^{59}Cl_3$ was added to this Grignard reagent, refluxed, extracted with benzene, and recrystallized. The use of the compound in determining concentrations in liquid phases is described. (T.R.H.)

11586

PROCESS FOR THE WET PRODUCTION OF URANIUM DOUBLE-FLUORIDE. (to Centro Informazioni Studi Esperienze). British Patent 831,905. Apr. 6, 1960.

A process for converting $UO_2(NO_3)_2$ into a double fluoride with an alkali or alkaline earth metal is described. In an example, a $UO_2(NO_3)_2$ solution is passed through a cationic resin to remove UO_2^{2+} ions. Then a Na_2SO_4 solution is passed through to recover UO_2SO_4. This solution is acidified and reduced over a Zr amalgam. Addition of HF precipitates the sodium double fluoride. (T.R.H.)

Analytical Procedures

11587 AECU-4699

California Research Corp., Richmond, Calif.

CHROMATOGRAPHIC SEPARATION AND ULTRAVIOLET ANALYSIS OF POLYPHENYLS. Report No. 15. W. W. West. Jan. 11, 1960. 33p. Contract AT(11-1)-174. OTS.

Chromatographic and spectrophotometric techniques for the separation and quantitative analysis of polyphenyl mixtures are described. Relative adsorbabilities of polyphenyls and alkylbiphenyls in different solvent-adsorbent combinations were determined. A systematic study of the effects of solvent, adsorbent, and structure type on adsorbabilities was made. Solvents with the greater eluting strengths were those having the higher dielectric constants. Both silica gel and alumina were found to be good for separating polyphenyls. Silica gel was the stronger adsorbent and was more useful for separating polyphenyls with two and three rings. By increasing the surface area of silica gel, its adsorbing power was found to be increased. Sterically hindered polyphenyl isomers were adsorbed less strongly; those with increased resonance, i.e., the para isomers, were adsorbed more strongly. Adsorbability data were used to develop a chromatographic procedure for the quantitative separation of a known mixture of biphenyl, o- and m-terphenyls, and m-quaterphenyl. The two terphenyls were separated from each other only slightly, but the other separations are good. Product recoveries were 98% or greater. An accurate and rapid ultraviolet spectrophotometric method was devised to analyze solutions of polyphenyls. Polyphenyl absorption coefficients in isooctane were determined. Absorbances of individual polyphenyls were found to conform to the Bouguer-Beer Law; absorbances of mixtures were additive. Wide ranges of concentrations of polyphenyls, either singly or as mixtures, were found to be accurately calculated from absorbency data. (auth)

11588 AERE-AM-2

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE DETERMINATION OF CAESIUM 137. G. J. Hunter. Nov. 1959. 10p. BIS.

Separation of Cs^{137} with inactive cesium carrier involving precipitation of cesium perchlorate, scavenging with ferric hydroxide, and precipitation of cesium chloroplatinate is described. If necessary a preliminary separation of the cesium from potassium and large amounts of sodium and ammonium is made by precipitation of cesium silicotungstate. The Cs^{137} is estimated by γ counting the chloroplatinate precipitate. The method is applicable to solutions of irradiated uranium that has cooled for a minimum period of four hours and to solutions containing potassium, sodium, and ammonium. The method does not discriminate against Cs^{134} and high results will be obtained if this nuclide is present. (auth)

11589 AERE-R-2879

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ABSORPTIOMETRIC DETERMINATION OF ALU-

MINIUM, AS A MINOR CONSTITUENT IN PLUTONIUM–ALUMINIUM ALLOYS. I. G. Jones and G. Phillips. Jan. 1960. 15p. BIS.

A method is described for the determination of 0.1 to 1% aluminum in plutonium alloys. The plutonium is separated by ion-exchange and the aluminum determined absorptiometrically, following extraction as the 8-hydroxyquinoline complex. Iron, which interferes, is removed by extraction with 8-hydroxyquinaldine, and any residual plutonium is removed by complexing with hydrogen peroxide, prior to the 8-hydroxyquinoline extraction. The method is probably applicable to a wider range of alloy compositions than that described. (auth)

11590 AERE-R-3092
United Kingdom Atomic Energy Authority. Research Group. Wantage Radiation Lab., Harwell, Berks, England.
GEIGER GAS COUNTING METHODS OF ASSAYING TRITIATED HYDROGEN AND TRITIATED WATER. J. F. Cameron and B. J. Puckett. Jan. 1960. 26p. BIS.

Methods are described for assaying tritium in hydrogen, water vapor, butane, and acetylene which are part of the gas filling of a self-quenching Geiger counter. It is concluded that the most satisfactory self-quenching filling for a Geiger counter is tritiated hydrogen with toluene as a quenching vapor. Absolute measurements on tritiated water are carried out by reducing the water over zinc at 425°C and introducing the hydrogen into a counter with a known sensitive volume. (auth)

11591 AERE-R-3147
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE CHEMICAL ANALYSIS OF TERNARY ALLOYS OF PLUTONIUM WITH URANIUM AND MOLYBDENUM. E. Foster and G. Phillips. Feb. 1960. 16p. BIS.

A procedure is described for the determination of plutonium, uranium, and molybdenum in their ternary alloys. The plutonium is separated from an acid solution of the alloy by absorption as the nitrate complex on a column of anion exchange resin. The uranium and molybdenum are recovered from the column effluent and determined without further separation. Uranium and molybdenum are determined absorptiometrically, the former as a uranyl sulfate complex in sulfuric acid solution and the latter as its thiocyanate complex. The plutonium is recovered from the column by elution with hydroxylamine hydrochloride and determined absorptiometrically using the Pu-III color. (auth)

11592 AERE-R-3212
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DETERMINATION OF BERYLLIUM BY THE PHOTONEUTRON METHOD. PART II. A STUDY OF METHODS FOR OVERCOMING INTERFERENCES. G. W. C. Milner, J. W. Edwards, and W. M. Henry. Jan. 1960. 19p. BIS.

A further study of the photoneutron method for beryllium was carried out to examine techniques for overcoming the interfering effects of elements with high cross sections for thermal neutrons. Techniques studied include the use of a cadmium shield to absorb thermal neutrons, a procedure employing standard addition, and another procedure using variations in the thickness of the sample. The cadmium shield technique proved the most successful and is recommended. (auth)

11593 AERE-R-3238
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
LIQUID SCINTILLATION COUNTING OF TRITIUM AT 22°C. W. P. Hutchinson. Jan. 1960. 9p. BIS.

Apparatus and procedure for counting small quantities of tritium are described. Using two photomultiplier tubes working in coincidence 0.001 micro-curies ±10% of tritium may be quantitatively estimated at room temperature. (J.R.D.)

11594 CEA-1230
France. Commissariat à l'Énergie Atomique, Paris.
DOSAGE DE TRACES DE CHROME DANS L'URANIUM. (Determination of Tracer Quantities of Chromium in Uranium). A. Huart. 1959. 20p.

A method is described for the photometric determination of chromium in uranium by absorbancy at 540 mμ of the Cr(VI) diphenylcarbazide combination. After attack by nitric acid, the solution is made perchloric, and the chromium oxidized at the boiling point by permanganate. Excess oxidant is removed by hydrochloric acid. Study of operating conditions resulted in a method with an accuracy of ±0.5 ppm for 0.5 to 15 ppm chromium in the metal. (auth)

11595 CF-59-3-108
Oak Ridge National Lab., Tenn.
COMPARISON OF TWO COLORIMETRIC METHODS FOR URANIUM. Roberta L. McCutchen. Mar. 25, 1959. 10p. OTS.

In order to establish the feasibility of using two colorimetric methods for the determination of uranium interchangeably, according to the interferences encountered in a particular sample, results were obtained by each of the methods and compared. The dibenzoyl methane method and the ethyl acetate-ammonium thiocyanate procedure were compared on the basis of values secured on the same day, on different days, on an analysis of the variance, and on an analysis of the residual error for the methods on different days. On the basis of the findings of these tests, it is concluded that the two methods can be used interchangeably to determine the uranium content of the ethyl acetate extracts of samples. Since the interferences in the two methods are different, the uranium content of a variety of materials can be determined without additional separations being required. (auth)

11596 CI-R-73
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF OXYGEN IN URANIUM METAL POWDER. J. A. Ryan, R. C. Cockaday, C. D. Lafferty, and J. R. Sanderson. Aug. 1953. 59p.

Commonly used methods for determination of oxygen in uranium metal powder are reviewed. Descriptions of selected procedures such as those used in the chlorine, bromine trifluoride, and aluminum methods are given. The aluminum method is considered best for routine use. (J.R.D.)

11597 HMI-B7
Hahn-Meitner-Institut für Kernforschung Berlin.
BESTIMMUNG VON MIKROMENGEN CHLORID IN WASSER. (Determination of Microquantities of Chloride in Water). H. U. Woelk. Nov. 1959. 14p.

A method is reported for determining the chloride content of very pure water in the concentration range from 2 to 100 γ. The basis of the method is the Zincke-Koenig reaction with modifications by Asmus and Kurandt.

An extension of the sensitivity of the method to the above mentioned range was accomplished through improvements in the apparatus, replacement of α-picoline with pyridine and an investigation of the relationships between achievable color intensities and other parameters. (auth)

11598 HW-20036

Hanford Works, Richland, Wash.

ANALYTICAL PROCEDURES FOR THE PLUTONIUM METAL FABRICATION PROCESS. XI. THE DETERMINATION OF FLUORIDE. G. J. Behling, E. W. Christopherson, and L. F. Kendall. Jan. 15, 1951. Decl. Mar. 7, 1960. 11p. Contract W-31-109-Eng-52. OTS.

A method was developed for the determination of 0.25 to 2.5 μg of fluoride in Pu. After dissolving the sample in $HClO_4$ and separating fluoride ion by distillation of fluosilicic acid, the quantity of fluoride is determined by measuring the intensity of color generated by the reaction between the fluoride and the Zr salt of p-dimethylaminoazophenylarsonic acid. (auth)

11599 HW-20212

Hanford Works, Richland, Wash.

ANALYTICAL PROCEDURES FOR THE METAL FABRICATION PROCESS. X. DETERMINATION OF CARBON IN PLUTONIUM METAL BY A MICRO-COMBUSTION METHOD. M. B. Leboeuf. Feb. 20, 1951. Decl. Mar. 7, 1960. 20p. Contract W-31-109-Eng-52. OTS.

Carbon in plutonium was determined by ignition in a Pt crucible with O_2 as subsequent condensation of the CO_2 in a liquid-N_2 trap. The CO_2 was allowed to sublime into a known volume and then measured. The estimated limit of sensitivity was 24 ppm on a 25 mg sample, and the precision is ±38% (99% limits). Water did not interfere. (T.R.H.)

11600 KAPL-970

Knolls Atomic Power Lab., Schenectady, N. Y.

ANALYSIS OF HYDROGEN–TRITIUM MIXTURES BY THE THERMAL CONDUCTIVITY METHOD. F. K. Heumann. July 1953. Decl. Mar. 15, 1960. 20p. Contract W-31-109-Eng-52. OTS.

The thermal conductivity method for the analysis of T in T-H mixtures was investigated using a thermal conductivity cell. A study was made of the variables involved that may cause errors in the analysis. These variables include the effect of certain gaseous impurities, variations in the bridge current, sample pressure, flow rate, and the effect of equilibration of T-H mixtures. (auth)

11601 LA-1733

Los Alamos Scientific Lab., N. Mex.

A SENSITIVE ANALYTICAL METHOD FOR CARBON IN URANIUM. William G. Smiley. May 1954. Decl. Mar. 15, 1960. 28p. Contract W-7405-eng-36. OTS.

The capillary trap method for the determination of carbon in metals was modified by using a manometer in which the gas is compressed to a small volume, giving a linear scale and sensitivity of 0.1 microgram of carbon per millimeter. Samples from pure uranium buttons gave standard deviations ranging from 1.4 to 3.2 ppm. Varying the sample size, in the range from 100 to 250 milligrams, did not affect the results significantly. The time required for an analysis was about 13 to 14 minutes. (auth)

11602 ORNL-2921

Oak Ridge National Lab., Tenn.

CONTROLLED POTENTIAL COULOMETRIC TITRATION OF PLUTONIUM—APPLICATION TO PRFR SAMPLES. W. D. Shults. Apr. 25, 1960. 29p. Contract W-7405-eng-26. OTS.

The controlled potential coulometric titration of plutonium and its application to Power Reactor Fuel Reprocessing pilot plant samples is discussed. Proper conditions for the satisfactory routine performance of this method and the effects of various potential interferences are established. Data are given which indicate the precision and accuracy to be expected under ideal and operating conditions. (auth)

11603 PGR-33(S)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.

ANALYTICAL METHOD FOR THE DETERMINATION OF RADIUM IN PITCHBLENDE ORE AND BARIUM SULPHATE CONCENTRATES. Feb. 1960. 17p. BIS.

The gamma activity of the sample in equilibrium with radon and its daughter elements is compared, under fixed geometrical conditions, with that of a radium standard in similar equilibrium. Corrections are made for the absorption of gamma radiation within the sample and its container, for the geometrical factors arising from the size and shape of the sample cylinder, for the characteristics of the counting equipment and, in the case of pitchblende ore, for the decay products UX_1 and UX_2. The method is suitable for the determination of radium in solid pitchblende ore and barium sulfate concentrates where the radium content is relatively high. (auth)

11604 PGR-63(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF HYDRAZINE DIHYDROCHLORIDE. 1959. 15p. BIS.

The hydrazine and the chloride contents of the sample are determined titrimetrically and the boron absorptiometrically. Sulfate is measured turbidimetrically and the sulfated residue, volatile matter, and water insoluble matter gravimetrically. (auth)

11605 PGR-67(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF KEROSENE. 1960. 16p. BIS.

The acidity, alkalinity, chloride content, and bromine number are determined titrimetrically. The distillation range, aniline point, specific gravity, and ignition residue are determined by conventional techniques. Hydrogen sulfide, elementary sulfur, mercaptans, and corrosive sulfur are detected by conventional tests. (auth)

11606 PGR-69(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Service Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF NITRIC ACID. Dec. 1959. 21p. BIS.

The nitric and nitrous acids are determined titrimetrically, as is the fluoride. Boron, iron, phosphorus, and silicon are determined absorptiometrically, while chloride is determined turbidimetrically. The ignition residue and sulfuric acid content are measured gravimetrically. (J.R.D.)

11607 PGR-72(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHOD FOR THE INSPECTION OF SODIUM DICHROMATE. 1959. 18p. BIS.

The assay is determined iodimetrically, and the boron, phosphorus, and silicon contents absorptiometrically. The acidity or alkalinity is measured titrimetrically, the sulfate turbidimetrically, and the chloride and water insoluble matter gravimetrically. (auth)

11608 PGR-75(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF POTASSIUM BROMATE. Jan. 1960. 12p. BIS.

The assay is determined iodimetrically and the boron absorptiometrically. The acidity or alkalinity is measured titrimetrically, the sulfate turbidimetrically and the volatile matter and water insoluble matter gravimetrically. (auth)

11609 PGR-76(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF HYDROCHLORIC ACID. Jan. 1960. 15p. BIS.

The assay is determined titrimetrically, and the boron, iron and phosphorus contents absorptiometrically. The insoluble matter, ignition residue, and sulfate are determined gravimetrically and the specific gravity with a hydrometer. (auth)

11610 PGR-85(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF SOLID SODIUM HYDROXIDE AND CAUSTIC LIQUOR. Jan. 1960. 17p. BIS.

For the solid material, the assay and carbonate content are determined titrimetrically and the boron, iron, and silicon absorptiometrically; sulfate and chloride are estimated turbidimetrically and the insoluble matter gravimetrically. For the caustic liquor, the assay, chloride, and carbonate content are determined titrimetrically and the specific gravity using a hydrometer. (auth)

11611 PGR-89(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF IRON POWDER. Feb. 1960. 26p. BIS.

A method for the quantitative analysis of iron powders is presented. The iron and the phosphorus content were determined volumetrically and the boron spectrophotometrically. Sulfur and carbon were measured by combustion techniques and the chloride turbidimetrically. Silicon and grease were determined gravimetrically and the grading by sieving. (auth)

11612 PGR-90(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF POTASSIUM BROMIDE. 1960. 14p. BIS.

The assay, acidity or alkalinity, and the chloride content are determined titrimetrically, and the boron absorptiometrically. The sulfate present is measured turbidimetrically and the volatile and water insoluble matter gravimetrically. (auth)

11613 SCS-R-48

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE ESTIMATION OF URANIUM IN ORES INVOLVING PRELIMINARY ADSORPTION OF IMPURITIES BY MEANS OF ACTIVATED CELLULOSE WITH PARTICULAR REFERENCE TO PITCHBLENDES. E. J. Armson, N. T. Cunningham, D. Bevan, and H. Mason. June 10, 1948. 6p.

The ore is dissolved in nitric acid, and the uranium in solution estimated after passing through a cellulose column with an ether/nitric acid mixture. It is found that nearly all of the impurities present are adsorbed on the column, the uranium passing through completely. (auth)

11614 SCS-R-91

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF THE MAJOR CONSTITUENTS OTHER THAN URANIUM IN BELGIAN CONGO ORE. A. B. Crowther, J. S. Wright, E. G. Bradfield, and R. M. Davies. Dec. 22, 1953. 31p.

Methods for determining the major constituents of Belgian Congo ore other than uranium are reviewed. A method is given for the determination of cobalt by precipitation with potassium ethyl xanthate from a nitric acid solution of the ore. After wet oxidation of the precipitate, it is titrated potentiometrically in ammoniacal citrate solution with potassium ferricyanide. A method for the determination of silicon is given in which the silica is dehydrated by fuming with perchloric acid. After filtration and ignition, it is volatized as the fluoride, and the silica is determined from weight loss. Nickel is determined from a solution of the ore in nitric acid by double precipitation with dimethyl glyoxime after addition of citrate ion, hydroxylamine, and ammonia. Molybdenum is determined by precipitation as lead molybdate after preliminary separation with benzoin oxime. Aluminum is determined by precipitation as the benzoate, thioglycolic acid being used to complex the iron. The aluminum is then estimated gravimetrically with oxime. A composite method is presented for the determination of lead, iron, aluminum, calcium, and magnesium. (C.J.G.)

11615 SCS-R-129

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF RUTHENIUM, RHODIUM, NIOBIUM AND ZIRCONIUM IN SEA-WATER. J. Rose. Mar. 27, 1950. 7p.

A method was devised for the determination of Ru, Rh, Nb, and Zr in sea water and recoveries were estimated. The elements present in aqueous solution as anions are co-precipitated as hydroxides with ferric hydroxide by treating the sea-water with sodium hydroxide at a controlled pH of 6.9, the iron having been previously added in the form of ferric oxide dissolved in nitric acid. The precipitate is ashed in a muffle furnace (700°C) and weighed. It is then ground and examined spectrographically by the iron flux method, using the rare earth type of dilution. Good recoveries were obtained with Rh, Nb, and Zr, but the recovery of Ru was only of the order of 60%, probably owing to the formation of complex ions. (auth)

11616 SCS-R-160

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF LITHIUM IN ALUMINIUM SULPHATE. J. Golden and F. J. Woodman. July 19, 1950. 11p.

A method for the determination of trace amounts of Li in $Al_2(SO_4)_3$ was developed, using the Lundegardh technique. The method involves conversion to Al_2O_3, extraction of Li with dilute HCl, and spectrographic examination of the extract. The method is suitable for the determination of Li in quantities of 1 to 5 ppm. (auth)

11617 TID-5656
Ionics, Inc., Cambridge, Mass.
INTERIM AND PROGRESS REPORT FOR PERIOD COVERING FEBRUARY 16 TO MARCH 15, 1960. Henry G. Petrow. Mar. 15, 1960. 17p. Contract AT(30-1)-2470. OTS.

The complete procedures for the determination of radium and thorium in uranium mill solutions are presented. The determination of Th^{232} by colorimetric methods is reported. (W.L.H.)

11618 WADC-TN-59-265
Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.
3,3′,4′,5,7-PENTAHYDROXYFLAVANONE AS A REAGENT FOR SPECTROPHOTOMETRIC DETERMINATION OF MOLYBDENUM IN STEEL. Frank L. Chan and Ross W. Moshier. July 1959. 9p. Project No. 7364.

A colorimetric method for analyzing molybdenum in steel was developed using the reagent 3,3′,4′,5,7-pentahydroxyflavanone (dihydroquercetin). By an extraction process, all interfering metals except tungsten are removed. The procedure is applicable for determining molybdenum in all substances not containing tungsten. (auth)

11619 AEC-tr-3997
ON THE DETECTION OF TRACE ELEMENTS SIMULTANEOUSLY USING SPECTROSCOPY AND PAPER CHROMATOGRAPHY. Marguerite E. Heros and Lucien N. Amy. Translated by J. A. Wheat (Savannah River Lab.) from Bull. soc. chim. France No. 3, 367-9(1955). 10p. JCL.

A method is given for the detection and identification of trace elements by separation of the elements by paper chromatography and subsequently characterizing them by spectrography. Results obtained in the detection of iron and manganese are discussed. (C.J.G.)

11620
ESTIMATION OF THE MICROGRAM AMOUNT OF THORIUM IN THE ARIMA HOT SPRING WATERS AND DEPOSITS. Shinnosuke Higashi (Shigematsu Lab., Japan). Bull. Inst. Chem. Research, Kyoto Univ. 37, 198-9(1959) May.

Included are procedures for the determination of microgram amounts of thorium in natural substances. The thorium content in the Arima Hot Spring Waters were estimated to be 10.2 to 21.7 microgram per liter and in the deposits 10.4 to 22.6 microgram per gram by a method of colorimetric analysis. These values were about one-tenth those estimated by the "thoron method." The problem of radioactive equilibrium in hot spring waters is discussed. (auth)

11621
SPECTROPHOTOMETRIC DETERMINATION OF URANIUM BY SOLVENT EXTRACTION AS ACETYLACETONATE. Masayuki Tabushi (Shigematsu Lab., Japan). Bull. Inst. Chem. Research, Kyoto Univ. 37, 237-44(1959) July.

Spectrophotometric determination of uranium, based on the extraction of uranyl acetylacetonate, was investigated. Uranyl acetylacetonate was nearly quantitatively extracted with butyl acetate at pH 6.5 to 7.0. The extracted chelate seemed to be an addition compound having a composition of $UO_2(C_5H_7O_2)_2 \cdot C_5H_8O_2$, and its absorption spectrum showed a maximum at 365 mμ. The color was stable, Beer's law was valid up to 70 ppm of uranium, and the molar extinction coefficient at 365 mμ was about 2640 (L/M cm). Titanium, chromium, manganese, ferric iron, and large amounts of copper interfered with the determination, but molybdenum, vanadium, tungsten, etc., did not interfere. (auth)

11622
EDTA TITRATION OF ZIRCONIUM, HAFNIUM, AND THORIUM IN THEIR ALLOYS WITH TUNGSTEN OR IN TUNGSTEN METAL. E. Lassner and R. Scharf (Metallwerk Plansee A.-G., Reutte, Tirol, Austria). Chemist Analyst 49, 22(1960) Mar.

A method is presented for the determination of hafnium, thorium, or zirconium metals or alloys in tungsten. The method involves the titration with ethylenediaminetetraacetate (EDTA) of a solution of the mixture in the presence of an indicator. The average absolute error was 0.02%. (B.O.G.)

11623
PHOTOMETRIC DETERMINATION OF TITANIUM IN THE FORM OF A PYRIDINE SALICYLATE COMPLEX. A. K. Babko and O. (A.) I. Volkova (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 12, 1336-9(1959). (In Ukrainian)

It is shown that titanium(IV) forms an intensely colored compound with salicylic acid and pyridine. This compound is slightly soluble in water and readily soluble in chloroform. On the basis of this reaction a method was developed for determining titanium. The yellow extract of the complex was photometrized at 400 or 430 mμ. The effect of iron, chromium, vanadium and other interfering elements was eliminated by thiosulfate before extraction. This determination of titanium is applicable in steels and in other materials. (auth)

11624
THE DETERMINATION OF THE OXIDES OF BERYLLIUM IN BERYLLIUM. Ying-chuen Wang, Yue Hsien, and Chinchan Ch'en. Hua Hsüeh Shih Chieh 13, 411-12(1958). (In Chinese) (Translated from Referat. Zhur. Khim. No. 11, 1959, abstract No. 38295).

A rapid and accurate method is described for the determination of Be in beryl, based on the decomposition of the beryl by fusion with NaF, complexing of the interfering cations with complexone III (I), precipitation of the Be^{2+} with a solution of $(NH_4)HPO_4$, and weighing of the Be as $Be_2P_2O_7$.

11625
DETECTION AND DETERMINATION OF TRITIUM LABELLED COMPOUNDS ON PAPER CHROMATOGRAMS. P. A. Osinski (Institut Interuniversitaire des Sciences Nucleaires, Brussels). Intern. J. Appl. Radiation and Isotopes 7, 306-10(1960) Feb. (In English)

Tritium labelled compounds on paper chromatograms are detected, localized, and the ratios of their activities determined precisely with a windowless scanner. Filter paper strip is pulled, by a wheel driven by a synchronous motor, between two windowless, flow, Geiger-Müller counters. The flow of argon saturated with propanol vapor provides an air-lock. Pulses from the Geiger tubes are fed to a precision, linear ratemeter and recorder with chart speed equal to that of the filter paper strip. The efficiency of counting tritium is low. The sensitivity limit lies aroung 3 mμc/cm^2 of Whatman No. 1 filter paper. (auth)

11626
TITRIMETRIC DETERMINATION OF URANIUM BY REDUCTION WITH THE CHLORIDE OF DIVALENT TIN. Sheau-shya Kao, Chia-shu Liu, and Wan-hsien Wu (Peking Univ.). Pei Ching Ta Hsüeh Hsüeh Pao—Tza Jan K'o Hsüeh 4, No. 1, 89-93(1958). (Translated from Referat. Zhur. Khim. No. 6, 1959, abstract No. 19115).

A study is presented of the catalytic action of Fe and

H_3PO_4 in the reduction of U^{6+} to U^{4+} with $SnCl_2$. It was found that reduction takes place quantitatively in a solution 4 to 6 M in HCl, ≥0.5 M in H_3PO_4. With a concentration H_3PO_4 ≤0.36 M, two polarographic waves are obtained, corresponding to reduction potentials of U^{6+} and U^{5+}, while with a concentration of H_3PO_4 ≥ 0.452 M only U^{4+}-ions are stabilized in solution due to complex-formation. Contrary to previously published data, it was found that addition of Fe for catalysis is not indispensable and therefore the necessity is eliminated of making a correction for the volume of $K_2Cr_2O_7$-solution. In the determination of U there are added to 10 ml of 0.02 to 0.03 N solution of U-salt, 4 to 6 N HCl, 0.02 N solution of Fe-salt, H_3PO_4 (1:1), 2 ml 5% solution $SnCl_2$, heated for 15 minutes at about 100°, after cooling added 10 to 20 ml of saturated $HgCl_2$ solution, 25 ml 0.05 N $Fe(NH_4)(SO_4)_2$, 5 ml of a mixture (1:3) of concentrated H_2SO_4 and H_3PO_4, and titrated with 0.01 to 0.02 N solution of $K_2Cr_2O_7$ in CO_2 atmosphere in the presence of diphenylamine sulfonic acid as an indicator. In addition to Fe^{3+} and Fe^{2+}, a study was made of Cu^{2+}, Co^{2+}, Ni^{2+}, and ICl, as catalysts. It was found that in absence of H_3PO_4 they also exercise an insignificant effect on reduction of U^{6+}. The described method is suitable for determination of U in U-containing materials.

11627

THE SPECTROCHEMICAL DETERMINATION OF NIOBIUM AND TITANIUM IN INDUSTRIAL TANTALIC ACID. K. Jordan and K. Picard. Tech. Mitt. Krupp 15, 203-7 (1957) Dec.

A method for the spectrochemical determination of niobium and titanium in industrial tantalic acid is given for the range 2 to 20% Nb_2O_5 and 0.1 to 3% TiO_2. In the method the oxide mixtures compressed with graphite to form tablets were excited by a condensed low-voltage discharge. As analytical lines the 3098.47 A niobium line, the 3017.19 A titanium II line, and the 3098.0 A tantalum line were used. Calibration curves were established for the range indicated, and their reliability was proved on a series of test samples. (tr-auth)

11628

SOVIET RESEARCH IN ANALYTICAL CHEMISTRY OF URANIUM, 1955—1957. Chemistry Collection Series. (In English Translation). New York, Consultants Bureau, Inc., 1959. 55p. $10.00.

A review of Russian research on the analytical chemistry of uranium for the period 1955 to 1957 is presented. The determination of uranium by fluorimetric, gravimetric, and spectrographic methods is described. Abstracts have been prepared for the 10 papers included. (C.J.G.)

11629

RAPID LUMINESCENT DETERMINATION OF URANIUM IN SOLUTIONS. A. F. Fioletova. p. 14-15 of "Soviet Research in Analytical Chemistry of Uranium, 1955—1957. Chemistry Collection Series." (In English Translation). New York, Consultants Bureau, Inc., 1959. $10.00.

The determination of uranium in solutions by visual observation of the luminescence of a bead of nonluminescent NaF fused with the test solution containing uranium is discussed. The effect of interfering elements was found to be removed by dilution and artificial addition techniques (C.J.G.)

11630

INVESTIGATION OF COMPLEX COMPOUNDS OF THE URANYL ION WHICH ARE OF IMPORTANCE IN ANALYTICAL CHEMISTRY. [PART] I. N. P. Komar and Z. A. Tretyak (Gorkii Kharkov State Univ., USSR). p.19-25 of "Soviet Research in Analytical Chemistry of Uranium, 1955—1957. Chemistry Collection Series." (In English Translation). New York, Consultants Bureau, Inc., 1959. $10.00.

This paper was previously abstracted from the original language and appears in NSA, Volume 9, as abstract No. 6635.

11631

NEW DATA ON THE CHEMISTRY OF SOME OF THE RARE ELEMENTS. I. V. Tananaev (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). p.68-74 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

Methods for determining the rare earth metals are reviewed. The reagents used in precipitating the rare earth metals are discussed. Chemical differences among the metals are discussed. (C.J.G.)

11632

SOVIET RESEARCH ON THE LANTHANIDE AND ACTINIDE ELEMENTS, 1949—1957. PART II. ANALYTICAL AND SEPARATION CHEMISTRY. (In English Translation). New York, Consultants Bureau, Inc., [1959]. 193p. $20.00.

Russian research performed between 1949 and 1957 on analysis and separation methods for the lanthanide and actinide elements is reported. Abstracts have been prepared for 28 of 30 papers contained. (C.J.G.)

11633

DETECTION OF CERTAIN RARE EARTH ELEMENTS WHEN PRESENT TOGETHER. L. M. Kul'berg and M. N. Ambrozhii (Ambrozhy) (Saratov State Univ., U.S.S.R.). p.147-52 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

A method was developed for the detection of lanthanum, cerium, and praseodymium in the presence of other rare earth elements, and the detection of neodymium in the presence of praseodymium and cerium. Phenol red is the reagent used to detect lanthanum, phenylanthranilic acid for cerium, an equilibrium solution of nickel dimethylglyoxime for neodymium, and o-tolidine for praseodymium. (auth)

11634

THE QUANTITATIVE SPECTROCHEMICAL DETERMINATION OF PRASEODYMIUM IN LANTHANUM AND OF EUROPIUM IN SAMARIUM ON THE ISP-22, A SPECTROGRAPH OF AVERAGE DISPERSION. G. Kryuger and R. R. Shvangiradze. p.153-63 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

A spectrochemical method for the determination of Pr in La (0.3 to 10%) and for Eu in Sm (0.02 to 10%) is described. The spectrum was excited in an a-c arc between copper electrodes, using $KHSO_4$ as the fixing agent. (C.J.G.)

11635

REMARKS ON A METHOD BASED ON FRACTIONAL CRYSTALLIZATION OF THE DOUBLE NITRATES OF MAGNESIUM AND THE RARE-EARTH ELEMENTS. G. Virts. p.164-8 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

The separation of rare earths of the cerium group by fractional crystallization of the double magnesium nitrates of these elements was investigated. The crystallization method of seeding the hot solution followed by slow cooling with vigorous stirring was found to give the best fractionation. (C.J.G.)

11636

THE USE OF PHYTIC ACID IN THE ANALYTICAL CHEMISTRY OF THORIUM. A. I. Ryabchikov, V. K. Belyaeva, and A. N. Ermakov (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). p.203-12 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 3345.

11637

SPECTROGRAPHIC ANALYSIS BY THE EVAPORATION METHOD. PART II. DETERMINATION OF IMPURITIES IN THORIUM AND BERYLLIUM COMPOUNDS BY THE METHOD OF EVAPORATION IN A VACUUM. A. N. Zaĭdel, N. I. Kaliteevskii (Kaliteevysky), L. V. Lipis, and M. P. Chaĭka (Leningrad State Univ.). p. 217-22 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6266.

11638

STUDIES IN THE BEHAVIOR OF ULTRA SMALL AMOUNTS OF THE ELEMENTS. PART II. MECHANISM OF THE COPRECIPITATION OF RADIOISOTOPES WITH HYDROXIDES. A. K. Lavrukhina (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). p.223-9 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., 1959. $20.00.

The relation between extent of coprecipitation of radioisotopes and amount of precipitated hydroxide of a nonisotopic carrier was studied. It was established that the amount of radioisotope coprecipitated with the hydroxide is equal to the amount of hydroxide which was separated. Deviations were observed only when a small amount of hydroxide (about 20%) was precipitated. The mechanism for coprecipitation with hydroxides was postulated in this manner: at pH values lower than that required for the beginning of precipitation of the hydroxide, formation of colloidal particles of the hydroxide of the nonisotopic carrier and the radioisotope with identical adsorbed cations occurs. During coagulation the nuclei of the colloidal particles of these hydroxides adhere together. According to this mechanism, it should be possible, from the logarithm of the ratio of the molar solubilities of the hydroxide of any metal and the radioisotope hydroxide, to estimate the extent of coprecipitation of the radioisotope with the given hydroxide during precipitation of the latter. (auth)

11639

A NEW ANALYTICAL METHOD OF DETERMINING PROTOACTINIUM. I. E. Starik, A. P. Ratner, M. S. Pasvik, and L. D. Sheidina (Radium Inst., Leningrad). p.230-3 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6289.

11640

CHROMATOGRAPHIC ANALYSIS. M. M. Senyavin. p.271-8 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

Developments in the chromatographic separation of mixtures of organic and inorganic compounds are reviewed. Applications of chromatography to the analysis of alloys and nuclear reaction products are discussed. (C.J.G.)

11641

QUANTITATIVE SPECTRAL ANALYSIS OF THE ISOTOPIC COMPOSITION OF ENRICHED URANIUM. A. R. Striganov, F. F. Gavrilov, and S. P. Efremov. p.297-305 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

A method for the spectrophotometric analysis of the isotopic composition of U is described. The behavior of standard calibrating curves was investigated over a wide range of concentration. It was established that the presence of a contaminant does not distort the results. (C.J.G.)

11642

MEASUREMENT OF SMALL CONCENTRATIONS OF α-ACTIVE SUBSTANCES IN WATER BY THE FREEZING-OUT METHOD. N. G. Gusev, D. P. Osanov, and V. P. Mashkovich. p.309-14 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 9030.

11643

THE SPECTRAL ANALYSIS OF SMALL SAMPLES OF ACTINIUM. N. I. Kaliteevskii and A. N. Razumovskii. p.324-7 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

A spectrographic method for the analysis of actinium was developed. The actinium spectrum was excited by an arc between copper or carbon electrodes in a CO_2 atmosphere. The wavelengths of the most intense actinium lines in the ultraviolet region of the spectrum are presented in tabular form. (C.J.G.)

Radiation Chemistry

11644 NLCO-801

National Lead Co. of Ohio, Cincinnati.

URANIUM PARTITION BETWEEN TRI-n-BUTYL PHOSPHATE AND AQUEOUS URANYL NITRATE SOLUTIONS. LABORATORY INVESTIGATION. T. J. Collopy and D. A. Stock. Dec. 10, 1959. 13p. Contract AT(30-1)-1156. OTS.

Various reagents were added to an aqueous uranyl nitrate solution to learn their effect upon uranium partition into tri-n-butyl phosphate (TBP) from an aqueous solution. Results showed that uranium partition from an aqueous solution into TBP was aided to a greater extent by adding increasing amounts of nitrate salts to a minimum quantity of nitric acid than by adding increasing amounts of nitric acid alone. The presence of anions (e.g., sulfate) which complex the uranyl ion in aqueous solution has a detrimental effect on uranium partition from aqueous solution into TBP, necessitating a higher concentration of hydrogen ion than in the absence of such anions. (auth)

11645 NP-8438

Southwest Research Inst., San Antonio.
DETECTION OF RADIATION INDUCED FREE RADICALS BY PARAMAGNETIC RESONANCE. Report No. 7 (Final) [for] Period November 14, 1957—May 13, 1959. W. W. Bradshaw and F. K. Truby. 67p. Project No. 7-84-01-002. Contract DA-19-129-QM-1060.

An electron paramagnetic resonance spectrometer was used to study the free radical production and reactions in some irradiated food constituents such as glycerol tristearate, related fatty compounds, and albumin. Peroxide determinations and oxygen uptake measurements were made to aid in EPR data evaluation. EPR measurements were extended to whole meat samples for a few samples. The effects of selected additives as free radical acceptors are also evaluated. (J.R.D.)

11646

UNSOLVED RADIOBIOLOGICAL PROBLEMS AND COMPARATIVE RADIATION RESEARCH. IV. EXPERIMENTAL INVESTIGATIONS ON AQUEOUS MODEL SYSTEMS OF CHLORINATED HYDROCARBONS AS CONTRIBUTION TO THE PROBLEM: "TARGET THEORY AND/OR THEORY OF INDIRECT RADIATION EFFECT." H. Dreiheller and E. H. Graul (Phillips-Universität, Marburg/Lahn, Ger.). Atompraxis 6, 59-65(1960). (In German)

The experiments made since 1954 with diluted aqueous solutions of chlorinated hydrocarbons are critically surveyed with regard to the usefullness of the theory of indirect radiation effect and its interpretations. The emphasis is on questions of the influence of the milieu on radiobiological and radiochemical primary processes. From studies on the concentration and temperature dependence of the radiochemical yields after γ irradiation of the hydrocarbon solutions, it is concluded that H and OH radicals must be involved in these milieu-dependent radiochemical processes. For a better understanding of the processes underlying this radiation-induced mechanism of radical formation, a "molecular-dynamic" model was constructed which can also be used for clarifying the dependence of radiochemical reactions upon pH and other milieu factors. The water—carbon tetrachloride system used in these model studies makes possible a relatively sensitive physicochemical radiation dosimetry as low as ~20 r. (auth)

11647

RADIATION CHEMISTRY OF CYCLOHEXANE. I. ISOTOPIC COMPOSITION OF HYDROGEN EVOLVED FROM MIXTURES OF C_6D_{12} AND C_6H_{12}. P. J. Dyne and W. M. Jenkinson (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem. 38, 539-43(1960) Apr.

The yield of D_2 formed by a unimolecular process in the γ-ray irradiation of cyclohexane-d_{12} was deduced from the isotopic composition of hydrogen evolved from C_6H_{12}—C_6D_{12} mixtures. A value of 0.25 molecule/100 ev is found for this "molecular" yield. This yield is only slightly reduced by iodine but is considerably reduced in the presence of biphenyl. (auth)

11648

INTENSITY VARIATIONS OF THE QUADRUPOLE NUCLEAR RESONANCE IN A MOLECULAR CRYSTAL BOMBARDED BY FAST ELECTRONS. A. I. Kitaĭgorodskiĭ and E. I. Fedin (Inst. of Organic Compounds, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 130, 1005-7 (1960) Feb. 11. (In Russian)

Nuclear quadrupole resonance was applied in determining radiation damage in n-dichlorobenzene polycrystalline specimens exposed to various doses of 750-kev electrons. It was found that carefully prepared monocrystalline specimens with a lattice close to ideal possess higher resistance to ionizing γ and β radiation than polycrystalline specimens. (R.V.J.)

11649

AN INVESTIGATION OF THE RADIOLYTIC OXIDATION OF DIVALENT IRON WITH IRRADIATION DOSES OF HIGH POWER. P. Ya. Glazunov and A. K. Pikaev (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 130, 1051-4(1960) Feb. 11. (In Russian)

Radiolytic oxidation of Fe^{2+} in sulfuric acid solutions at up to 10^{23} ev/ml · sec dosage was investigated. The pulse modulator used is described. The $G(Fe^{3+})$ magnitudes measured at various doses were tabulated. The data reveal that the $G(Fe^{3+})$ value begins to reduce at dosages of $\sim 10^{22}$ ev/ml · sec. The probability of H-OH radical recombination resulting from overlapping of ionization particles $H + H \rightarrow H_2$; $H + OH \rightarrow H_2O$; $OH \cdot OH \rightarrow H_2O_2$ is increased with the increase of the dosage, which in turn causes a drop in the $G(Fe^{3+})$ value. (R.V.J.)

11650

REVERSIBLE ALTERATIONS IN THE PERMEABILITY OF POLYMERS TO GASES CAUSED BY GAMMA RAYS. N. S. Tikhomirova, Yu. M. Malinsiĭ, and V. L. Karpov (Karpov Inst. of Physics and Chemistry, [Moscow]). Doklady Akad. Nauk S.S.S.R. 130, 1081-4(1960) Feb. 11. (In Russian)

Radioinduced reversible changes in the penetrability of polymers to gases were studied for gamma doses up to 700 rad/sec. Measurements of helium and xenon penetration through polyethylene and polytetrafluoroethylene at various dosages are tabulated. The penetrability constants were calculated by Fick's equation for constant flow. The diffusion of helium (t = 17°C) at 300 rad/sec is accelerated three fold and at 730 rad/sec (t = 10°C) it is about ten fold. (R.V.J.)

11651

THE SYNTHESIS OF NON-RANDOM COPOLYMERS BY THE GAMMA IRRADIATION OF EMULSION SYSTEMS. [PART] II. P. Hayden and R. Roberts (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Appl. Radiation and Isotopes 7, 317-22(1960) Feb. (In English)

Non-random copolymers have been synthesized by irradiation of vinyl monomers emulsified in polymeric latices. In particular, the synthesis of copolymers of polytetrafluoroethylene is described. The reaction products were resolved by either fractional precipitation or fractional solution. (auth)

11652

RADIATION CHEMISTRY OF CARBOHYDRATES. PART III. THE EFFECT OF GAMMA-RADIATION ON AQUEOUS SOLUTIONS OF D-FRUCTOSE. G. O. Phillips and G. J. Moody (University Coll., Cardiff, Wales). J. Chem. Soc., 754-61(1960) Feb.

The degradation of D-fructose in aqueous solution by Co^{60} γ-radiation was examined by measuring the changes in acidity, absorption spectra, and optical rotation with dose. Hydrogen peroxide and carbon dioxide formation were measured. Paper chromatographic and radioactive tracer methods revealed that the main products were glucosone, 2-oxogluconic acid, oxalic acid, and two-carbon aldehydic fragments. Isotope dilution and absorption spectra indicate the formation of three-carbon aldehydic fragments. By following the yield-dose curves for the main products, the primary and secondary products are identified. These products are considered to arise from at least three types of degradation process: (a) oxidation of the primary alcohol group at position 1 to form glucosone, which is then converted into 2-oxogluconic acid (there is also evidence of a similar process occurring at position 6); (b) direct scission between C_2 and C_3 to form two- and four-carbon aldehydic fragments which are subsequently oxidized; (c) symmetrical scission of the molecule to form glyceraldehyde and glycerosone. (auth)

11653

RADIATION CHEMISTRY OF CARBOHYDRATES. PART IV. THE EFFECT OF GAMMA-RADIATION ON AQUEOUS SOLUTION OF SUCROSE. G. O. Phillips and G. J. Moody (University Coll., Cardiff, Wales). J. Chem. Soc., 762-8(1960) Feb.

Yield-dose curves obtained from isotope dilution and paper chromatographic methods reveal that glucose and fructose are primary products of γ-irradiation of aqueous sucrose solutions, together with smaller amounts of glucosone and gluconic acid. Glucuronic acid, 2-oxogluconic acid, arabinose, and two- and three-carbon aldehydic fragments arise in secondary processes. In the final stages carbon dioxide and formic acid are formed. Hydrogen peroxide is produced continuously. The amounts of volatile and non-volatile acid formed, and changes in optical rotation and absorption spectra, were determined. Thus, the degradation of sucrose is related to two types of oxidative scission of the disaccharide linkage. (auth)

11654

THE ACCELERATING EFFECT OF METHANOL ON THE GAMMA RADIATION-INDUCED GRAFT COPOLYMERIZATION OF STYRENE TO POLYETHYLENE. George G. Odian, Albert Rossi, and Edward N. Trachtenberg (Radiation Applications Inc., New York). J. Polymer Sci. 42, 575-8(1960) Feb.

Dilution of styrene in its γ radiation-induced graft copolymerization to polyethylene with methanol was found to increase the rate of grafting. This effect is at a maximum at about 50% (by volume) MeOH concentration and is ascribed to a Trommsdorff-type acceleration. This acceleration can explain the irregularity of the slope of the initial grafting rate vs. concentration MeOH graph for concentrations less than 50% and the drop of the rate for concentrations greater than 50%. (D.L.C.)

11655

CHEMISCHE REACTIES ONDER INVLOED VAN GASONTLADINGEN EN GAMMASTRALING. (Chemical Reactions Under the Influence of Gas Discharges and Gamma Radiation). Tjeerd Hoekstra. Thesis, Delft, Netherlands, Technological University, 1958. 126p.

The effects of gas discharges on some liquid hydrocarbons were studied. The voltol process was carried out on the laboratory scale. The results of an investigation of the composition of linseed oil after polymerization in a gas discharge are presented. An apparatus for the study of chemical reactions occurring under the influence of gamma radiation is described. The results of gamma radiation experiments carried out with hydrocarbons are given. The $G(H_2)$-values were determined by measuring the rate of gas formation. (Reactor Centrum Nederland).

11656

RADIOLYTIC POLYMERIZATION OF CYCLOPENTADIENE. (to Esso Research and Engineering Co.). British Patent 831,319. Mar. 30, 1960.

A method is given for polymerization of cyclopentadiene and its homologs under certain conditions of irradiation, temperature, and solvent to produce a product useful as a cross-linking agent, drying oil, or lacquer component. In an example, cyclopentadiene is kept cold (0°C or below) while receiving 16 megaroentgens of γ radiation from Co^{60} over a period of 68 hr. After irradiation the sample was diluted with cyclohexane and part was hydrogenated over platinum oxide catalyst (1800 std. cu. ft. H_2 absorbed per pound at 60 psi and 15°C) and brought to 60°C. After distilling off the solvent, a hard polymer was obtained in about 10% yield. Thus the high temperature and pressure normally required for the hydrogenation are avoided. (T.R.H.)

11657

IMPROVED IRRADIATED RESINS. (to Esso Research and Engineering Co.). British Patent 831,842. Apr. 6, 1960.

An irradiated petroleum resin and its preparation are described. In an example, a gas-oil distillate (b.p. 200 to 400°C) obtained by steam-cracking was distilled, and the 20° to 135°C fraction was heated 6 hours at 125°C to dimerize the cyclopentadienes. This product was 18% C_6H_6, 7% $C_6H_5CH_3$, <1% C_8 aromatics, 15% diolefins, 59% olefins, and 1% paraffins by weight. After adding 1 wt.% $AlCl_3$ catalyst the mixture was polymerized at 30°C, the polymer was separated, melted, mixed with divinyl benzene, and irradiated 87 hr at 335,000 R/hr. This final product did not melt at 220°C and was largely insoluble in n-heptane. (T.R.H.)

11658

IMPROVEMENTS IN IRRADIATION PROCESS. (to General Electric Co.). British Patent 831,914. Apr. 6, 1960.

The preparation of stable, cross-linked polypropylene by irradiation is described. In an example, sections of polypropylene were irradiated to 40 × 10^6 rep in N_2 over the range 60 to 200°C and percent cross-linking was determined by dissolution in toluene. It was found that maximum cross-linking occurs at 100 to 125°C. In other examples it is shown that annealing between 130 and 200°C results in a flexible product. The polypropylene can be blended with polyethylene prior to irradiation to produce another series of useful products. (T.R.H.)

Radiochemistry

11659 NAS-NS-3005

National Research Council. Committee on Nuclear Science.

THE RADIOCHEMISTRY OF FLUORINE, CHLORINE, BROMINE AND IODINE. Jacob Kleinberg and G. A. Cowan (Los Alamos Scientific Lab.). Jan. 1960. 46p. OTS.

This volume which deals with the radiochemistry of fluorine, chlorine, bromine, and iodine is one of a series of monographs on radiochemistry of the elements. A review of the nuclear and chemical features of particular interest to the radiochemist, a discussion of problems of dissolution of a sample and counting techniques, and a collection of radiochemical procedures for the elements as found in the literature are included. (W.L.H.)

11660 NAS-NS-3007

National Research Council. Committee on Nuclear Science.

THE RADIOCHEMISTRY OF CHROMIUM. J. Pijck (Univ. of Ghent). Jan. 1960. 38p. OTS.

A review of the nuclear and chemical features of particular interest to the radiochemist, a discussion of problems of dissolution of a sample and counting techniques, and a collection of radiochemical procedures for the element as found in the literature are included. (W.L.H.)

11661 IGIS-93(RD/W)
SORPTION OF RADIOACTIVE ISOTOPES BY FERRIC HYDROXIDE. V. V. Pushkarev. Translated by G. R. Taylor (U.K.A.E.A., Sellafield) from Zhur. Neorg. Khim. 1, 170-8(1956). 14p.

In order to establish the optimum conditions for precipitation of radioactive isotopes with ferric hydroxide under the conditions of purification of radioactive effluent liquors and production of radioactive isotopes, and also for proper understanding of the processes of precipitate-formation in natural water supplies, an investigation of the sorption by ferric hydroxide precipitates of ions of Cs^{137}, Sr^{89}, Sr^{90}, Ce^{144}, and Ru^{106} in microconcentrations was carried out. It was established that Cs is not significantly adsorbed under any experimental conditions. The sorption of Sr, Ce and Ru reaches a maximum at a specific pH value for each ion, namely: Ru 6.0, Ce 6.5, Sr 9.0. At pH greater than 9.0 partial peptization of ferric hydroxide occurs. An increase in temperature raises the degree of sorption considerably. It was also established that the difference in sorption of the ions on ferric hydroxide formed in the radioactive solution and on a previously prepared (1 h before sorption) hydroxide precipitate is insignificant. The chemistry of the processes of sorption of the stated ions by ferric hydroxide is discussed. It is accepted that Ru and Ce are adsorbed by an ion-exchange mechanism and Sr by formation of a ferrite. (auth)

11662
THE ISOLATION OF TECHNETIUM BY COPRECIPITATION OR ANION EXCHANGE. Fujio Ichikawa (Japan Atomic Energy Research Inst., Tokyo). Bull. Chem. Soc. Japan 32, 1126-9(1959) Oct.

Methods are given for the isolation of Tc^{99m} from fission products by coprecipitation and anion exchange. In the coprecipitation method, the precipitate was in the molybdate (Mo^{99}) form of lead, calcium, silver, etc., for the various procedures. Of these, the yield of Tc^{99m} from $PbMoO_4$ was the best, while silver was next with 50 to 60% yield. In the anion exchange techniques, technetium was not eluted with 10% NaOH but was eluted with 3 to 7 N HNO_3. The process was very slow and unpredictable for other acids and for dilute HNO_3. The yield was 40 to 45% in Tc^{99m} at 95% purity for 7.5 N HNO_3. (B.O.G.)

11663
INCORPORATION OF TRITIUM INTO TRANS-STILBENE BY THE GAS EXPOSURE METHOD. G. G. Cameron, N. Grassie, and S. J. Thomson (The University, Glasgow). J. Chem. Soc., 1411-12(1960) Mar.

A method is described for the preparation of tritiated trans-stilbene by gas exposure. Two grams of pure stilbene were exposed to 2c of tritium for 16 days. The yield of the purified product was 45% and the activity was 3.94×10^4 μc/mole. (B.O.G.)

Raw Materials and Feed Materials

11664 BMI-250
Battelle Memorial Inst., Columbus, Ohio.
REFINING OF MgX AND OTHER URANIUM-BEARING MATERIALS. R. A. Ewing, R. L. Belcher, S. J. Kiehl, Jr., and A. E. Bearse. Dec. 31, 1950. Decl. Mar. 7, 1960. 55p. Contract AT-30-1-GEN-228. OTS.

A study of the effect of feed and ether acidity on the extraction of vanadium and molybdenum from process solutions by ethyl ether is described. Results of batch and continuous extraction tests on the extraction of uranium from process slurries by tributyl phosphate-Gulfspray naphtha are presented, including studies of the effects of feed and scrub acidities on the concurrent extraction of molybdenum. The effect of temperature on the stripping of uranium from tributyl phosphate was studied briefly. Results from fractional precipitation of MgX from dilute sulfuric acid solutions indicate that, in the presence of sufficient iron, phosphate is precipitated as ferric phosphate, and not as uranyl phosphate. (auth)

11665 BMI-254
Battelle Memorial Inst., Columbus, Ohio.
REFINING OF MgX AND OTHER URANIUM-BEARING MATERIALS. Quarterly Progress Report. R. A. Ewing, S. J. Kiehl, Jr., R. E. Sharpe, and A. E. Bearse. June 30, 1951. Decl. Mar. 7, 1960. 51p. Contract AT-30-1-GEN-228. OTS.

Investigations on problems related to the use of MgX and other feed materials in the Plant 6 U refinery at St. Louis, Mo., have continued, with emphasis on the extraction of process feeds by neutral ether. Results of Scheibel column extraction tests with neutral ether on a variety of pitchblende, MgX, and V-20 soda salt feed materials indicate that the addition of Fe to complex interfering elements can reduce U losses in raffinates to lower levels than are attainable with acid ether in the absence of Fe. The beneficial effect of neutral ether on transfer of contaminants, especially Mo, to the ether extract was substantiated. It is indicated that the inclusion of V-20 soda salt in a feed tends to increase U losses in extraction; the addition of Fe was shown to be advantageous here also. Sources and costs of added Fe are considered. (G.Y.)

11666 BMI-266
Battelle Memorial Inst., Columbus, Ohio.
REPORT ON IDENTIFICATION OF REACTION PRODUCTS FORMED DURING MAGNESIUM REDUCTION OF URANIUM TETRAFLUORIDE. C. M. Schwartz and D. A. Vaughan. May 15, 1953. Decl. Mar. 2, 1960. 16p. Contract AT-30-1-Gen-228. OTS.

This report describes the results of x-ray diffraction examination of reaction products from a series of experiments performed by Mallinckrodt Chemical Works as an aid in understanding the process of bomb reduction of UF_4. UF_4 is initially reduced to UF_3 by magnesium at 560°C, and subsequently to metal at 600°C. MgF_2 from the initial reaction forms a coating on the magnesium which retards the final spontaneous reaction. (auth)

11667 CCCO-400
Catalytic Construction Co., Philadelphia.
PROCESS ENGINEERING REPORT ON PRODUCTION OF THORIUM AT IOWA STATE COLLEGE. H. H. Bulkowski, G. V. Holby, C. Pfeiffer, J. B. Maerker, and F. W. Winn. Jan. 16, 1952. Decl. Mar. 15, 1960. 72p. OTS.

The results of a detailed study of the AEC Th production facilities at Iowa State College, Ames, Iowa are presented. This study was made to obtain a thorough understanding of Th processing technology so that a process design for the FMPC Th production facilities could be made. The processing methods for the production of massive Th metal, starting with mantlegrade $Th(NO_3)_4$, were conceived and developed at Iowa State College. Initially, the process included solvent extraction to separate $Th(NO_3)_4$ from the bulk of the impurities present in the commercial salt. This step is by-passed in their present operations, since it was found that Th metal of adequate purity would be produced without the use of solvent extraction. In addition to the $Th(NO_3)_4$ process described, H_2SO_4 process for recovering Th from monazite sands was developed. (auth)

11668 CRL-AE-166

Gt. Brit. Chemical Research Lab., Teddington, Middx., England.

THE EXTRACTION AND CONCENTRATION OF THORIUM FROM ORES. PART V. FURTHER STUDIES ON THE RECOVERY FROM MONAZITE WITH THE AID OF CELLULOSE PHOSPHATE FOLLOWING SULPHURIC ACID ATTACK. A. J. Head, N. F. Kember, and R. P. Miller. Apr. 1958. 27p.

The process previously outlined for the recovery of thorium from liquors obtained by sulfuric attack on monazite using cellulose phosphate (C.R.L./A.E.140) has been further investigated. The presence of appreciable quantities of phosphate in the final concentrate has been shown to be due to the adsorption of a cationic species of thorium phosphate. The preparation of cellulose phosphate has been studied systematically and conditions determined whereby this effect can be reduced and also the physical properties of the adsorbent improved. Optimum conditions of ion-exchange column size and flow rates of solutions have been determined for the operation of this process, and the probable number of successive adsorption and elution cycles to which cellulose phosphate may be subjected has been estimated. (auth)

11669 HW-19932

Hanford Works, Richland, Wash.

CONVERSION OF UNH TO UO_3. Terminal Report. R. F. Maness and F. Clagett. Jan. 10, 1951. Decl. Mar. 2, 1960. 18p. Contract W-31-109-Eng-52. OTS.

Experimental results indicate that the production of UO_3 by the continuous calcination process is practicable. (W.L.H.)

11670 NP-8421

Eldorado Mining and Refining Ltd. Research and Development Div., Ottawa.

MONTHLY REPORT [OF] DEVELOPMENT, JANUARY 1960. 17p. (D-60-1).

Carbonate leaching of Beaverlodge weekly leach feed samples and mine samples is reported. It was found that phosphate addition to the digestion will control thorium extraction under steady conditions. Glass fiber gage has proven to be very effective in removing finely dispersed water from acidic refinery solvent. A comparison of inclusion size between cast and forged billets is presented. An investigation was made of the effect of sintered density of UO_2 on decomposing ADU prior to reduction. (W.L.H.)

11671 SCS-R-126

Gt. Brit. Springfields Works, Springfields, Lancs, England.

IMPROVED PREPARATION OF PURE U_3O_8. H. J. P. Rogers. Mar. 10, 1950. 7p.

A method of preparing U_3O_8 is described. It consists of the purification of uranyl nitrate hexahydrate, its conversion with formic acid into uranyl formate, and the ignition of this substance. The U_3O_8 so formed has a packing density as high as that made by dried ignition of the nitrate, it is spectrographically pure and it requires very little grinding. (auth)

11672

NUCLEAR GRADE URANIUM TETRAFLUORIDE BY THE MOVING BED PROCESS. F. H. Hueston (Eldorado Mining and Refining, Ltd., Port Hope, Ont.). Can. J. Chem. Eng. 38, 29-32(1960) Feb.

A plant for the production of nuclear grade uranium tetrafluoride by the Moving Bed Process has been designed, built, and successfully operated at Eldorado's Port Hope Refinery. An exceptionally high grade uranium tetrafluoride, low in unconverted uranium oxides and uranyl fluoride can be obtained. A large percentage of the production exceeds 99% uranium tetrafluoride. Total metal contamination is less than 150 ppm. (auth)

11673

URANIUM TRIOXIDE IN A FLUIDIZED BED REACTOR. W. C. Philoon, E. F. Sanders, and W. T. Trask (Mallinckrodt Chemical Works, St. Charles, Mo.). Chem. Eng. Progr. 56, No. 4, 106; 108; 110; 112(1960) Apr.

A continuous method for the production of uranium trioxide from uranyl nitrate solution was developed, and its advantages over the batch process pointed out. Uranyl nitrate and fluidizing air are sprayed into the reactor, heat being supplied by molten heat transfer salt. The UO_3 product overflows from the reactor into a packaging station. The best range of temperatures was found to be 600 to 800°F. Production rates of 50 to 150 lb UO_3 per hour were attained; at rates higher than 150 lb/hr, uranyl nitrate clogged the off-gas system. The product was granular 99.0% UO_3 and had a high bulk density, 3.5 to 4.3 g/cm^3. Operating conditions, e.g., temperature, were found to have a pronounced effect on particle size. (D.L.C.)

11674

ANODES FROM URANIUM DIOXIDE IN A MOLTEN CHLORIDE ELECTROLYTE. M. V. Smirnov and L. E. Ivanovskii (Ivanovsky) (Ural Branch, Academy of Sciences, USSR). p. 61-4 of "Soviet Research on the Lanthanide and Actinide Elements, 1949—1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

Electrodes were prepared from uranium dioxide for use as anodes in the electrolysis of molten chlorides at current densities up to 3 amp/cm^2. The behavior of uranium dioxide anodes of composition $UO_{2.04}$ in a molten mixture of potassium and lithium chlorides was studied at 650°F. It was established that they go into solution in the interval of current densities ranging from 0.001 to 1 amp/cm^2, forming uranyl ions in the electrolyte in 100% yield based on the current. The excess oxygen accumulates in the anode, while the UO_2^{++} ions, in their discharge at the cathode, give a deposit of uranium dioxide of stoichiometric composition. The polarization of uranium dioxide anodes of composition $UO_{2.04}$ was measured at 550°F in a melt of chlorides. It was found that at current densities below 0.05 amp/cm^2, the potential at the anode is more negative by 0.57 v than the potential of the chlorine electrode, and changes but slightly with the current density. Substantial polarization is observed above 0.05 amp/cm^2. It is postulated that electrodes made from uranium dioxide behave in melts the same as do metallic electrodes. Their potential is determined by the molar concentration of UO_2^{++} ions in the electrolyte. (auth)

11675

PREPARATION OF SLIGHTLY SOLUBLE COMPOUNDS OF QUADRIVALENT URANIUM USING RONGALITE. A. A. Grinberg, L. E. Nikolskaya, G. I. Petrzhak, B. V. Ptitsyn, and F. M. Filinov (Radium Inst., Academy of Sciences, Leningrad). p.65-7 of "Soviet Research on the Lanthanide and Actinide Elements 1949—1957. Part I.

Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

A method of reducing uranyl salts with rongalite ($NaHSO_2 \cdot CH_2O \cdot 2H_2O$) is described. It was found that uranium(IV) can be quantitatively isolated from oxalic acid or hydrogen fluoride with rongalite and no sulfur is precipitated. (C.J.G.)

11676

HYDROMETALLURGICAL PROCESSES AT HIGH PRESSURES. F. A. Forward and J. Halpern. p.93-109 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

A review of hydrometallurgical processes used in the treatment of certain ores at high temperatures is presented. Various leaching and pressure precipitation processes are considered. The thermodynamic and kinetic factors which influence hydrometallurgical processes are discussed. (C.J.G.)

11677

HEATS OF FORMATION OF PuO_2 AND U_3O_8. M. M. Popov and M. I. Ivanov. p.110-13 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

The heats of formation of PuO_2 and U_3O_8 were determined by burning pure plutonium and uranium in a bomb calorimeter. The heats of formation for PuO_2 and for U_3O_8 were determined to be −252.4 ± 1.1 and −856.5 ± 3.1 kcal_{20°/mole, respectively. (auth)

Separation Processes

11678 AERE-R-3146

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A CONTRIBUTION TO THE THEORY OF THE HYDRAULIC CYCLONE, AND DATA ON THE PERFORMANCE OF SMALL DIAMETER CYCLONES. PART 3. D. Bradley. Dec. 1959. 51p. BIS.

Equations for determining the operating efficiency of small diameter cyclones were derived. Efficiency measurements were made of particle size and concentration for poly- and mono-disperse feed materials. Agreement between experimental and theoretical data was good. The effects of flow rate and cyclone diameter on solids elimination efficiency are graphically shown. Cyclone performance comparisons were made for various flow rates. The effects of underflow pot and its operation at both low and high flow rates were studied. (C.J.G.)

11679 BMI-1427

Battelle Memorial Inst., Columbus, Ohio.

DISSOLUTION OF IRRADIATED CONSOLIDATED EDISON POWER-REACTOR FUEL BY THE SULFEX AND DAREX PROCESSES. Robert A. Ewing, Harvey B. Brugger, and Duane N. Sunderman. Mar. 10, 1960. 23p. Contract W-7405-eng-92. OTS.

Losses of fertile and fissile materials during chemical decladding of irradiated prototype Consolidated Edison power-reactor fuel pins by the Sulfex and Darex processes were determined, on a laboratory scale, in all-glass apparatus. For air-fired low-density (−85 per cent of theoretical) fuel cores, minimum losses of uranium, thorium, and plutonium were in the 0.1 to 0.2 per cent range, by either process. These losses increased if the dejacketed cores were allowed to remain in contact with the cladding solution. No selectivity of dissolution of core components was apparent. Comparable losses were obtained with similar unirradiated fuel pins. Irradiated core pellets showed a tendency to shatter. When shattered core pellets were present, losses to the cladding solution were excessive. Losses of from 0.5 to 4.5 per cent were observed, depending on the extent of core fragmentation and the time of contact with the cladding solution. No correlation between burnup and extent of shattering was discernible. Core dissolution times were not lengthened by irradiation to the 175 to 300-Mwd/t core level. (auth)

11680 CEA-1262

France. Commissariat à l'Énergie Atomique, Paris.

EXTRACTION DES SULFATES PAR LES AMINES A LONGUES CHAINES. (Extraction of Sulfates by Long Chain Amines). Christiane Boirie. May 20, 1959. 55p.

Thesis submitted to Univ. of Paris.

The extraction of sulfuric acid by long chain amines in organic solution has been studied with a view to determining the value of the stability constants of the amine sulfates and bisulfates formed. Uranium sulfate and thorium sulfate were chiefly studied. The formulas of the complexes extractible with amines have been established, as well as the corresponding dissociation constants. For uranium sulfate the formula of the complex depends only on the nature of the amine, whereas for thorium this formula varies with the amine structure. From the formulas determined and the value of the constants calculated, it was possible to establish the best conditions for uranium and thorium extraction and also for a separation of these two elements. Finally an application of this study is made to the determination of uranium in ores, where the separation of uranium by this method is particularly easy and complete. (auth)

11681 CF-59-11-122(Rev. 1)

Oak Ridge National Lab., Tenn.

SRE FUEL ELEMENTS REPROCESSING—SAFETY REPORT. B. B. Klima. Feb. 5, 1960. 37p. Contract [W-7405-eng-26]. OTS.

An analysis has been made of the steps taken to assure safe handling of the SRE fuel elements during reprocessing in the Power Reactor Fuels Reprocessing Program, mechanical phase, cell complex in Building 3026. (auth)

11682 CF-60-3-4

Oak Ridge National Lab., Tenn.

THOREX PILOT PLANT: RUN AWD-2 SUMMARY. W. T. McDuffee. Mar. 1, 1960. 19p. OTS.

Results are reported for the processing and recovery of 99.9% isotopic purity U^{233} from Pa^{233}-rich raffinates collected during the Thorex short-decay thorium processing runs. The mass-233 material balance across the Thorex short decay runs was revised to reflect the smaller quantity of U^{233} actually measured and recovered in processing the raffinates than originally estimated to be present. The modified flowsheets are contained. (auth)

11683 DOW-160

Dow Chemical Co. Western Div., Pittsburg, Calif.

EXTRACTION OF URANIUM FROM IMC PHOSPHORIC ACID WITH VARIOUS DIALKYLPYROPHOSPHORIC ACIDS. James E. Magner. Sept. 1, 1957. 16p. Contract AT-30-1-GEN-236. OTS.

Various dialkylpyrophosphoric acids were tested as extractants for uranium from International Minerals phosphoric acid. Included in the testing program were didecyl esters prepared at International Minerals (fresh plant ester and recycle plant ester) and esters prepared in this laboratory (didecyl and dicapryl derivatives). (auth)

11684 CEA-tr-A-207

QUELQUES RECHERCHES SUR LES COLONNES D'EXTRACTION. (Research on Extraction Columns). A. Guyer and K. Meuli. Translated into French from Helv. Chim. Acta 38, 955-9(1955). 9p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 9, as abstract No. 6231.

11685

SOLVENT EXTRACTION IN RADIOCHEMICAL SEPARATIONS. Henry Freiser (Univ. of Arizona, Tucson). Ann. Rev. Nuclear Sci. 9, 221-44(1959).

The classification and principles of solvent extraction systems employed in radiochemical separation are presented. Solvent extractions employing chelate and ion association systems are discussed. The apparatus employed in solvent extractions in radiochemical separations is described. (C.J.G.)

11686

SOLVENT EXTRACTION OF URANIUM WITH CHLOROFORM AS ACETYLACETONATE. Masayuki Tabushi (Shigematsu Lab., Japan). Bull. Inst. Chem. Research, Kyoto Univ. 37, 226-31(1959) July.

Conditions for the extraction of uranium with chloroform as its acetylacetonate were investigated. Extraction recovery of uranium acetylacetonate was increased with increasing concentration of acetylacetone in aqueous solution at the optimum pH value of 6 to 7. The presence of sodium chloride increased the extraction yield of uranium acetylacetonate, and the favorable extraction pH range was broadened to 5 to 7.2. An addition of ethylenediaminetetraacetic acid solution resulted in a decrease of extraction, but its effect was prevented by the addition of sodium chloride. In the presence of ethylenediaminetetraacetic acid, the extraction pH range was 7 to 7.5. By the use of ethylenediaminetetraacetic acid as a masking agent, uranium was separated from the activity of mixed fission product and from thorium by extracting with chloroform as acetylacetonate. Recovery was about 95%. (auth)

11687

THE RECOVERY OF URANIUM DURING THE THERMAL PROCESSING OF PHOSPHATE ROCK. Fathi Habashi (Univ. of Tech., Vienna). Energia nucleare (Milan) 7, 210 (1960) Mar. (In English)

Finely ground Kosseir phosphate samples were mixed with such materials as cryolite, CaF_2, $CaCl_2$, KCl, or NH_4Cl, pasted with gelatin, pelleted, dried, and heated at 1300°C in a stream of dry N_2. The N_2 was scrubbed in Na_2CO_3 solution which was analyzed for U. The U was not volatilized effectively by these treatments. It was thought that stable, non-volatile $CaUO_3$ and CaU_2O_7 are formed by the heating. (T.R.H.)

11688

EXTRACTION AND PURIFICATION OF RaE IN SOLUTIONS OF RADIOLEAD BY PAPER CHROMATOGRAPHY. P. Conte and R. Muxart (Institut du Radium, Paris). J. Chromatog. 3, 96-7(1960) Jan. (In French)

A method for extracting RaE from an HCl solution of RaD, its daughters, and Pb is described. A Ni strip is placed in the solution and the RaE, Po, RaD, and Pb deposit on it. The deposit is removed by HNO_3 and the Ni is removed by descending chromatography. Final purification is by ascending chromatography. (T.R.H.)

11689

REACTOR FUEL REPROCESSING IN THE US. J. A. Leary (Los Alamos Scientific Lab., N. Mex.). J. Metals 12, 341-3(1960) Apr.

A survey of processes used in reprocessing reactor fuels is given. These are divided into three classes: aqueous reprocessing, pyrometallurgical reprocessing, and volatility processing. The three main processes: Redox, Purex, and Thorex, under aqueous reprocessing, are to be used in the United States for reprocessing civilian reactor fuels. These processes are intended for complete decontamination of the fissionable material so that fuel can be refabricated by direct handling methods. (B.O.G.)

11690

ION EXCHANGE METHOD FOR SEPARATION OF RADIOISOTOPES OF TELLURIUM, ANTIMONY AND TIN. Ignacy Stronski and Władimir N. Rybakow (Instytut Badań Jadrowych, Krakow and Instytut Badań Jadrowych, Dubna, USSR). Rocznini Chem. 33, 1177-81(1959). (In Polish)

The separation of small amounts of Sb and Te on EDE-10P and ASD-2 ion exchangers and also of Sn, Sb, and Te on ASD-2 was studied using the radioisotopes Sb^{124}, Te^{127m}, Sn^{113}, and Sn^{123}. The results of the separation of Te, Sb, and Sn were compared to the widely used Dowex 1 × 8; on this basis it can be stated that the Soviet-produced anion exchanger ASD-2 compares favorably for separation of Te, Sb, and Sn. (tr-auth)

11691

EXTRACTION OF URANYL α-NITROSO-β-NAPHTHOLATE AND SEPARATION OF URANIUM FROM VANADIUM AND IRON. I. P. Alimarin and Yu. A. Zolotov (Lomonosov Moscow State Univ.). p.1-5 of "Soviet Research in Analytical Chemistry of Uranium, 1955–1957. Chemistry Collection Series." (In English Translation). New York, Consultants Bureau, Inc., 1959. $10.00.

This paper was previously abstracted from the original language and appears in NSA, Volume 11, as abstract No. 9274.

11692

URANYL AND THORIUM SELENITES. E. I. Krylov and V. G. Chukhlantsev (Kirov Ural Polytechnical Inst., USSR). p.26-30 of "Soviet Research in Analytical Chemistry of Uranium, 1955–1957. Chemistry Collection Series." (In English Translation). New York, Consultants Bureau, Inc., 1959. $10.00.

This paper was previously abstracted from the original language and appears in NSA, Volume 11, as abstract No. 12299.

11693

INVESTIGATION OF THE CONDITIONS OF FORMATION AND OF THE STABILITY OF COMPLEX OXALATE COMPOUNDS OF Pu(III) IN AQUEOUS SOLUTIONS. A. D. Gel'man, N. N. Matorina, and A. I. Moskvin (Inst. of Physical Chemistry, Academy of Sciences, USSR). p.83-6 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

The complexes of Pu(III) with oxalate, citrate, carbonate, and ethylenediaminetetraacetate were studied by a spectrophotographic method to determine the stability toward oxidation. The bluish-colored compounds were found to be stable toward oxidation only when the experiments were performed in an atmosphere of nitrogen or in the presence of a strong reducing agent. The solubility products of the Pu(III) oxalate complex in water at 20 and 70°C were calculated to be 1.62×10^{-25} to 2.52×10^{-22}, respectively. The total dissociation constants of the complex ions $[Pu(HC_2O_4)]^-$ and $[Pu(C_2O_4)_2]$ were determined to be 1.1×10^{-11} and 7.1×10^{-16}, respectively. (C.J.G.)

11694
THERMODYNAMICS OF THE EXTRACTION EQUILIBRIA FOR URANYL NITRATE. A. M. Rozen. p.114-28 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

The fundamental thermodynamic principles of the extraction equilibria for uranyl nitrate are examined. The equilibrium characteristics are associated with considerable nonideality of the aqueous phase—a strong electrolyte, and the organic phase—a practically undissociated nonelectrolyte. It is shown that, at ionic strengths of up to 10, ion association in the aqueous phase does not significantly influence the distribution of uranyl nitrate. (auth)

11695
DETERMINATION OF THE COMPOSITION AND INSTABILITY CONSTANTS OF COMPLEX Pu^{+3} OXALATE IONS. A. D. Gel'man, N. N. Matorina, and A. I. Moskvin. p.129-34 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 6541.

11696
INVESTIGATION OF THE FORMATION CONDITIONS AND STABILITY OF COMPLEX Pu^{+3} COMPOUNDS BY A SPECTROPHOTOMETRIC METHOD. A. D. Gel'man and A. I. Moskvin. p.135-7 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part I. Basic Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $15.00.

The formation of Pu^{+3} complexes with $C_2O_4^{-2}$, CO_3^{-2}, and $C_6H_5O_7^{-3}$ ions and with Trilon B was demonstrated by a spectrophotometric method. The absorption spectra exhibit characteristic maxima at the following wave lengths: 565, 605, 665, 780 to 790, 905 to 910, and 1090 mμ. (auth)

11697
EXTRACTION METHODS FOR SEPARATION OF ELEMENTS. V. M. Vdovenko. p.265-70 of "Soviet Research on the Lanthanide and Actinide Elements, 1949–1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

A review is presented of separation processes for various elements, including both theoretical and experimental work. (C.J.G.)

11698
IMPROVEMENTS IN OR RELATING TO METHODS OF SEPARATING PLUTONIUM. (to United Kingdom Atomic Energy Authority). British Patent 831,862. Apr. 6, 1960.

A method is given for recovering Pu from nitrate solutions of irradiated U. The Pu^{4+} is treated with a ferric salt in the presence of acetate ions at pH 4.8 to 5.1 to precipitate basic ferric acetate which carries down Pu. The procedure can be repeated until the desired separation is achieved. (T.R.H.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

11699 AD-207216
Detroit Arsenal. Materials Lab., Centerline, Mich.
REDUCED EXPOSURE TIME FOR INDUSTRIAL RADIOGRAPHIC METHODS. Report No. 4318 (Final). Otto Renius and R. A. Pulk. Nov. 10, 1958. 23p.

The variation in intensity and spectral distribution of radiation emitted from the focal spot of a 1000 kvp resonant transformer x-ray source unit was determined, as measured across the surface of the focal spot. The effects introduced by filtration, utilized in reducing the focal spot to film distance, were measured. (C.J.G.)

11700 AECU-4730
Southwest Research Inst., San Antonio.
CYCLIC PRESSURE TESTS OF LARGE SIZE PRESSURE VESSELS. Progress Report No. 16 for January 15, 1960 to February 15, 1960. M. M. Lemcoe. 18p. Project No. 773-2. Contract AT(30-1)-2140. OTS.

The test vessel was cycled at 4325 psi internal pressure to 6845 cycles after repairing a nozzle leak which occurred at 5174 cycles. The cycling pressure of 4325 psi was based on the Lehigh cantilever beam fatigue test for A-201-B material; however, cracks appeared in the schedule 80 pipe material from which the nozzle was fabricated. It is recommended that cantilever fatigue test materials be obtained for use in future tests. After completion of inspections at 6845 cycles further testing was conducted. Other nozzle crack conditions are described and plans for future tests are given. (J.R.D.)

11701 DEGR-43(R)
United Kingdom Atomic Energy Authority. Development and Engineering Group, Risley, Lancs, England.
THE CRITICAL PRESSURE OF A TUBE WITH AN ECCENTRIC BORE. J. P. Ellington. Oct. 14, 1959. 12p. BIS.

The critical pressure for collapse under a uniform external pressure has been found for a tube with a circumferential variation in wall thickness. Numerical methods were used to obtain a solution, but, using a Rayleigh-Ritz method, an analytical solution valid over a limited range was also found. Over the range of tolerances on eccentricity of bore likely to be found in practice, it is concluded that there is no very great reduction in critical pressure. (auth)

11702 NP-8426
Naval Engineering Experiment Station, Annapolis.
AN INVESTIGATION OF DIESEL ENGINE OIL FILTRATION AND ABRASIVE WEAR WITH HIGH DETERGENCY LUBRICANTS BY MEANS OF RADIOACTIVE TRACER TECHNIQUES. Harry Halliwell. Aug. 20, 1959. 32p. (EES-620320A and EES-830003).

A study designed to evaluate the relative effects of full-flow and bypass filtration, abrasive particle size, and detergent additive level of diesel lubricating oils on piston ring wear in a General Motors 3-71 type diesel engine was conducted using radioisotope tracer techniques. The detergent-type oils greatly reduced the amount of piston ring wear in comparison to the nonadditive oil. However, when abrasive contaminants were added to the lubricating oil system, the detergent additive oils permitted much more piston ring wear than the nonadditive oil. The detergent-type oils did not reduce the ability of either full-flow or bypass filters to remove wear debris from the oil system. Filters reduced wear rates appreciably, both with and without abrasives added to the oil. Full-flow filters were more effective than bypass filters in reducing wear when abrasives were added and just as effective as the bypass type with the higher detergent oils in the absence of abrasive. Bypass filters were the more effective ones with oils of low or no additive content when no abrasives were added. The use of radioactive chromium-faced steel piston rings and a monitoring system employing a scintillation detector and pulse height analyzers permitted rapid and quantitative determination of wear rates under various operating conditions. (auth)

11703 NP-8457
General Electric Co. Light Military Electronics Dept., Schenectady, N. Y.
RESEARCH ON LIQUID METALS AS POWER TRANSMISSION FLUIDS. Progress Report No. 3 [for] March 1, 1959 to June 1, 1959. R. C. Kumpitsch. June 1959. 26p. Project No. 8-(1-7331). Contract AF33(616)-5917.

The research effort, during this report period, on liquid metals as power transmission fluids was concerned with establishing a 1-gpm, 3000-psi, 1000°F, NaK-77 test flow loop. The low-pressure portion (console) of the test loop has been completely assembled A control panel for operation of the loop was fabricated. The "console" was installed in the liquid metals test area and completely instrumented, with exception to the loop's low-pressure sensing and recording equipment. The design of the high-pressure NaK pump mounting and speed drive fixture for the inert atmosphere "glove box" was completed. This fixture is currently being constructed. Continuing progress is being made on the manufacture of the high pressure-temperature NaK staged gear pump. No improvement in the delivery schedule for this pump has been obtained. Difficulty is being experienced in the procurement of correctly fabricated carbide material for this NaK pump. Negotiations are currently underway with both the pump and material vendors to resolve the problem. The revised liquid metals program schedule is included. (auth)

11704 NP-8458
General Electric Co. Light Military Electronics Dept., Schenectady, N. Y.
RESEARCH ON LIQUID METALS AS POWER TRANSMISSION FLUIDS. Progress Report No. 4 [for] June 1, 1959 to February 1, 1960. R. C. Kumpitsch. Feb. 1960. 27p. Project No. 8-(1-7331). Contract AF33(616)-5917.

Continued effort was applied in establishing a 1 GPM, 3000 psi, 1000°F, NaK-77 (liquid metal) flow test loop. This test loop, when completed, will be used in the research of determining the feasibility of using liquid metals as high temperature, hydraulic power transmission fluids. Progress is reported toward completion of the test equipment including completion of the low pressure portion (console) of the test loop, and installation of the high pressure NaK pump mounting and speed drive fixture in the inert atmosphere glove box. The high pressure NaK pump is currently 60 percent complete. Delivery of the unit is scheduled for April 15, 1960. Three components were added to the liquid metals test loop. These components consist of two over-pressure relief valves and a high temperature liquid metals servo. (For preceding period see NP-8457.) (auth)

11705 TID-5696
General Electric Co. Missile and Space Vehicle Dept., Philadelphia.
HIGH ENERGY STORAGE CERAMIC CAPACITOR. Quarterly Report No. 10. (for) April 1, 1959—June 30, 1959. J. M. Blank. 66p. Contract AT(30-1)-1963. OTS.

The purpose of the research is the development of ceramic materials with high dielectric constant and high dielectric strength values, and suitable for use as dielectrics in capacitors capable of storing large amounts of energy in small volumes. The theory that high density in a ceramic disk would cause high dielectric strength proved to be false. An examination of capacitors with the highest dielectric strengths disclosed that they had small grain size. A series of samples was prepared with Ba and Co additions which suppress grain growth. Two hundred 1-inch diameter capacitors accumulated over a two-year period were evaluated and are reported in detail. Some of the thoretical considerations originally used to guide the development of the storage capacitor are reviewed. An effort to evaluate methods of electroding other than evaporated silver was continued. Experiments on isostatic pressing are described. (For preceding period see AECU-4286.) (W.D.M.)

11706 TID-5704
Franklin Inst. Labs. for Research and Development, Philadelphia.
PERTURBATION ANALYSIS OF THE STABILITY OF SELF-ACTING, GAS-LUBRICATED JOURNAL BEARINGS. Interim Report. Vittorio Castelli and Harold G. Elrod, Jr. Feb. 1960. 31p. Sponsored by DOD; AEC; Maritime Administration; and NASA under Contract Nonr-2342(00). (I-A2049-11). OTS.

The dynamics of a gas-lubricated journal bearing are studied by using Reynold's equation and the Lagrangian equations of motion. This system of equations is then linearized by the perturbation method. The stability of the bearing is then investigated by studying the location in the complex plane of the roots of the characteristic determinant of the solution of the system of governing equations. (auth)

11707 AEC-tr-4033
THERMODYNAMIC INVESTIGATIONS OF HIGHLY-LOADED BOILER HEATING SURFACES. K. R. Schmidt. Translated by Lydia Venters (Argonne National Lab.) from Mitt. Ver. Grosskesselbesitzer, No. 63, 391-?(1959). 24p. JCL.

The mechanics of film boiling for a system with a given heat transfer and for a system with a given temperature are discussed. The parameters affecting thermal flow are considered. The dependence of a boiler on operational parameters such as flow rate, diameter of the inner tube, direction of the flow, pressure, inlet enthalpy, and heat loading was investigated. Measurements of the excess temperatures of the tube walls, pressures, and temperatures of the tube walls, pressures, and temperatures at the inlet and outlet of the tube were made on tubes of various diameters with varying flow velocities. The effect of increasing the flow velocity on film boiling revealed a leveling of the maxima and shifting of the beginning point of the partial film boiling after higher enthalpies. The dependence of the temperature of the inner wall tube at different thermal loadings on the enthalpy of water is shown graphically. Heat transmission by a tube wall to water and to overheated steam was analyzed. (C.J.G.)

11708 JPRS-2397
ON THE THERMAL PROCESSES IN AN ELECTROMAGNETIC INDUCTION PUMP. J. Lielpeteris. Translated from Latvijas PSR Zinātnu Akad. Vēstis, No. 9, 91-100 (1959). 13p. OTS.

An analysis of thermal processes in an induction pump of planar construction was made. Basic schemes of the thermal processes are discussed. The heat exchange process between the liquid metal and the walls is discussed for pumps with forced cooling systems, with and without compensation for heat loss by the liquid metal, and for pumps without forced cooling. Calculations on steady and transient thermal processes were made. (C.J.G.)

11709
STROBOSCOPIC RADIOGRAPHY WITH A LINEAR ACCEL-

ERATOR. B. J. Vincent (Armament Research and Development Establishment, Fort Halstead, Kent, Eng.). Brit. J. Appl. Phys. 11, 132-5(1960) Mar.

High-definition stroboscopic radiographs of an internal combustion engine were obtained. Efficient use of the large accelerator output has enabled fine-grain film and a large film-focus distance to be used. The radiographs were used to check the performance of the engine valves under running conditions. Comparison is made with stroboscopic radiography using a betatron. Methods of synchronization and some possible uses of stroboscopic radiography are briefly discussed. (auth)

11710
SHELL-AND-TUBE HEAT EXCHANGERS. Charles E. Drake and John R. Carp (Patterson-Kelley Co., Inc., East Stroudsburg, Penna.). Chem. Eng. 67, No. 8, 165-70(1960) Apr. 18.

Commercial shell-and-tube heat exchangers are discussed and classified on the basis of how well they meet the requirements for: (1) allowance for differential thermal expansion, (2) means of forcing fluid through the tubes, (3) means of controlling fluid flow through the shell, and (4) facility of maintenance and servicing. Among the types discussed are the U-tube, fixed tubesheet, and floating-head types. (D.L.C.)

11711
INVESTIGATION OF THE STRESSED AND STRAINED STATE OF SHORT THICK-WALLED CYLINDERS SUBJECTED TO AXISYMMETRICAL LOADING WITH THE AID OF COMPUTERS IN THE CASE OF ARBITRARY RADIAL LOADING. O. (A.) L. Kvitka (Kiev Polytechnic Inst.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 10, 1071-6(1959). (In Ukrainian)

11712
INVESTIGATION OF THE STRESSED AND STRAINED STATE OF SHORT THICK-WALLED CYLINDERS SUBJECTED TO AXISYMMETRICAL LOADING WITH THE HELP OF COMPUTERS IN THE CASE OF ARBITRARY AXIAL LOADING. O. (A.) L. Kvitka (Kiev Polytechnic Inst.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 12, 1300-5 (1959). (In Ukrainian)

11713
IMPROVEMENTS IN HANDLING PLANT FOR SPENT NUCLEAR REACTOR FUEL ELEMENTS. Richard Arthur Taylor (to Babcock & Wilcox, Ltd.). British Patent 831,323. Mar. 30, 1960.

A system for transporting irradiated fuel elements from reactor to storage pond is described. It has a rotor-container which can be positioned for receiving and discharging several fuel elements. (T.R.H.)

11714
IMPROVEMENTS IN OR RELATING TO LIQUID-LIQUID CONTACTING APPARATUS. Maurice Charles Tanner and Leonard Lowes (to United Kingdom Atomic Energy Authority). British Patent 831,383. Mar. 30, 1960.

A mixer-settler with air-pulsed mixing tubes is described. The mixing tubes dip into the mixer compartments and a double-acting piston and cylinder arrangement moves the liquid and mixes it by the alternating increase and decrease of pressure. The system includes a filled U-tube arrangement which prevents escape of radioactivity and transmits pressure to the mixing tubes. The mixing occurs when the lighter phase is drawn into the tube and expelled into the heavy layer. The stroke and frequency of the pressure pulses are controlled by adjusting the distance between actuator switches connected to the piston rod. (T.R.H.)

11715
IMPROVEMENTS IN NUCLEAR FUEL ELEMENT HANDLING APPARATUS. James Miller Nicol (to Babcock & Wilcox, Ltd.). British Patent 831,722. Mar. 30, 1960.

A reactor loading-unloading apparatus is described. A holder is pivoted to move from the receiving to the discharging position. (T.R.H.)

Heat Transfer and Fluid Flow

11716 AERE-R-3090
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ACCURATE MEASUREMENT OF TURBULENT FLOW IN PIPES USING RADIOACTIVE ISOTOPES. THE ISOTOPE VELOCITY TECHNIQUE. C. G. Clayton, Anne M. Ball, and W. E. Clark. Dec. 1959. 17p. BIS.

The ultimate accuracy of the isotope velocity method for measuring the flow of fluids in turbulent motion contained in pipes and open channels of constant and known cross section was investigated. The measurements were made using water flowing at 7 and 17 cfs in a pipe of 20 in. diam. The results, which were obtained by comparison with an absolute system of direct weighing, indicate that the isotope velocity method can be operated with an error of ±1%. (auth)

11717 CAL-AD-1118-A-7
Cornell Aeronautical Lab., Inc., Buffalo.
HEAT TRANSFER FROM DISSOCIATED GASES IN A SHOCK TUBE. R. A. Hartunian and P. V. Marrone. Nov. 1959. 78p. Contract AF18(603)-141. (AFOSR-TN-59-1087).

Measurements of the heat transfer from dissociated oxygen to the side-wall of a shock tube were made over a wide range of operating conditions using the methods of thin-film thermometry. Numerical solutions of the equilibrium shock-tube wall boundary-layer equations for several values of the Lewis number were obtained. The results show the heat transfer to be very weakly dependent upon the Lewis number. Experimental data obtained in the equilibrium boundary-layer regime agree with the theory at the low temperatures, and rise above the theoretical curves at the higher temperatures. This difference between theory and experiment is attributed to the uncertainty in the calculated viscosity coefficient used in the theory. The experiments were used to determine values for the viscosity coefficient of high temperature, dissociated oxygen. These values are considerably higher than those predicted theoretically using a Lennard-Jones potential or Sutherland's formula. Techniques by which thin-film thermometers can be used to measure heat transfer from ionized gases and to study the effects of surface catalytic efficiency on the heat transfer from dissociated gases are described. The results of exploratory experiments using the latter technique are discussed. Calculations are presented which illustrate the reductions in heat transfer to the stagnation point of re-entering vehicles that may be achieved through the use of a noncatalytic surface. (auth)

11718 CEA-1266
France. Commissariat à l'Énergie Atomique, Paris.
SUR LE CALCUL DE L'ÉCART DE TEMPÉRATURE DANS LA PAROI D'UN CANAL CIRCULAIRE, CHAUFFÉ ÉLECTRIQUEMENT, LORSQUE LES CONDUCTIVITÉS ÉLECTRIQUE ET THERMIQUE VARIENT AVEC LA TEMPÉRATURE. (On the Calculation of the Temperature Difference

in the Wall of an Electrically Heated Circular Canal, When the Electrical and Thermal Conductivities Vary with Temperature). R. Gerber. 1959. 9p.

The wall correction is given as a function of the temperature of the insulated face, in the form of a series in which the first terms are presented. The convergence is studied and a maximum estimate is made of the error committed when only the first terms of the development are retained. (auth)

11719 MSAR-60-30
MSA Research Corp., Callery, Penna.
AN EXPERIMENTAL STUDY OF PARTIAL FILM BOILING REGION WITH WATER AT ELEVATED PRESSURES IN A ROUND VERTICAL TUBE. Technical Report 71. J. B. McDonough and W. Milich. Mar. 16, 1960. 51p. Contract NObs-77023.

A study to determine the surface flux in the partial film boiling region of water at 800, 1200, and 2000 psia was made in a $^1/_4$ in. OD vertical Inconel-X tube, 0.152 in. ID × 12$^1/_2$ in. long. The water parameters were: mass flow rates approximately 0.2×10^6 to 1×10^6 lb/hr-ft^2 at inlet enthalpies of about 200 Btu per lb to approximately 670 Btu per lb. NaK was used as the heating medium. The experimental techniques by which the data were obtained and a description of the experimental loop, test section, sample data reduction method and analysis of experimental errors are described. The data reported in a previous experiment were incorporated with the data collected in this report to develop a satisfactory correlation for the surface flux in the transition boiling region. The local partial film boiling data were correlated by means of the following equation for round tubes $(\Phi DNB - \Phi Z/T_w - T_{DNB}) = 730\, e^{0.475 \times 10^{3}(1/P)}$. The range of variables applicable to this correlation are tabulated. (auth)

11720 NAA-SR-Memo-4469
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
BURNOUT PROTECTION REQUIREMENTS AND PRELIMINARY BURNOUT PROTECTION SYSTEM DESIGN. R. F. Audette. Oct. 7, 1959. 13p. OTS.

Tests were conducted to determine the time required to develop a rupture (burnout) in an AOMR tubular test section once burnout conditions are established. Preliminary designs of a protection system based on these data are included. (J.R.D.)

11721 NASA-TN-D-133
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
MEASUREMENTS OF HEAT TRANSFER AND FRICTION COEFFICIENTS FOR HELIUM FLOWING IN A TUBE AT SURFACE TEMPERATURES UP TO 5900°R. Maynard F. Taylor and Thomas A. Kirchgessner. Oct. 1959. 29p. OTS.

Measurements of average heat-transfer and friction coefficients and local heat-transfer coefficients were made with helium flowing through electrically heated smooth tubes with length-diameter ratios of 60 and 92 for the following range of conditions: average surface temperature from 1475 to 4533°R, Reynolds number from 3230 to 60,000, heat flux up to 345,000 Btu per hour per square foot of heat-transfer area, and exit Mach number to 1.0. In general, the data of this investigation correlated with air data at lower temperatures obtained in previous investigations. (auth)

11722 TID-5673
Columbia Univ., New York. Engineering Research Labs.
HYDROSTATIC PRESSURE DROP IN TWO PHASE FLOW. John H. Vohr. Dec. 4, 1959. 7p. (IX-TN-2-59). OTS.

Calculations were made to determine the hydrostatic pressure drop in two-phase fluid flow. (W.L.H.)

11723 UCRL-9023
California. Univ., Berkeley. Lawrence Radiation Lab.
DOWNFLOW BOILING AND NONBOILING HEAT TRANSFER IN A UNIFORMLY HEATED TUBE (thesis). Robert LeRoy Sani. Jan. 4, 1960. 94p. Contract W-7405-eng-48. OTS.

Local heat-transfer coefficients in forced convection, downflow boiling, and nonboiling were measured by use of an electrically heated type-304 stainless steel tube (0.7194 in. i.d. × 0.7502 in. o.d. × 68.0 in. long). Average forced-convection heat-transfer coefficients in turbulent one-phase flow and local total pressure gradients in two-phase flow were also determined. Data were obtained for the boiling of distilled water with mass fluxes of 51 to 165 lb/sec sq ft, heat fluxes from 13.8×10^3 to 49.8×10^3 BTU/hr sq ft, pressures at 15.8 to 30.9 psia, and qualities up to 14%. The boiling heat transfer data were compared with the correlations proposed by Mumm, Dengler, Rohsenow, and Grossman and Schrock. No attempt was made to formulate a new correlation because of the limited range of conditions investigated. The nonboiling heat transfer data were compared to the Dittus-Poelter and Sieder-Tate correlations. The local total pressure gradients in two-phase flow were correlated by the Martinelli parameter, X_{tt}, for turbulent two-phase flow. (auth)

11724 IGIS-53(RD/W)
APPROXIMATE CALCULATIONS OF LIQUID-METAL HEAT TRANSFER. K. D. Voskresenskii and E. S. Turilina. Translated by G. R. Taylor (U.K.A.E.A., Windscale) from p.87-92 of "Teploperedacha i Teoriya Tepla," Academy of Sciences, U.S.S.R., Moscow, 1959. 8p.

Approximate calculations are given of heat transfer during turbulent flow of liquid metals in smooth tubes. (W.L.H.)

11725
AN EXPERIMENTAL STUDY OF HEAT TRANSFER IN FLAT SLOT CHANNELS SUBJECT TO HIGH HEAT LOADING. Yu. P. Shlykov, Atomnaya Energ. 8, 144-5 (1960) Feb. (In Russian)

The feasibility of utilizing available formulas in calculations of convective heat transfer in flat-slot channels subjected to high heat loading was verified by 65 experiments made with heat transfer to non-boiling water in channels 22 mm wide with 1 mm and 1.5 mm clearance. Water velocity was varied from 5 to 12 m/sec and the heat load from 3.6 to 5.7×10^6 kcal/m^2/hr. The water entrance temperature varied from 45 to 80°C, with 50 atm. pressure in the circuit. (R.V.J.)

11726
AN INVESTIGATION OF THE DISTRIBUTION OF VAPOR CONTENTS IN A BOILING BOUNDARY LAYER BY MEANS OF β-RAYING. M. A. Styrikovich and E. I. Nevstrueva (Krizhazhanovskiĭ Energetic Inst., Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 130, 1019-22(1960) Feb. 11. (In Russian)

The distribution of vapor in the boiling boundary layer was studied by passing a fine plane-parallel β-ray beam through the medium. A stationary counter was used for measuring local vapor containing boundaries at various distances. The regularities in the boiling process at various thermal loads up to and beyond critical were investigated with certain heating surface arrangements and materials. The data describe a different mechanism of boiling and refute the existing concept of the relationship between the appearance of and certain constant magnitudes in boiling layer vapor content. (R.V.J.)

11727

HEAT LOSS OF CYLINDRICAL BODIES OF SMALL DIMENSIONS IN A TRANSVERSE CURRENT OF AIR. O. (A.) O. Kremnov and M. (N.) T. Dukhnenko (Power Engineering Inst., Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 12, 1316-21(1959). (In Ukrainian)

The heat loss of single thin wires and a packet of them in a transverse current of air was studied. Intensification of heat loss was found to be due to the effect of the cylindrical form of the boundary layer and to the reduction of its thickness with decrease in diameter. The high coefficients of heat loss in single thin wires and in a packet of wires confirm the possibility of a considerable intensification of the heat loss processes in industrial heat exchange apparatus by applying this kind of heat exchange surface with transverse flow of air around them. Experimental dependences for calculating the heat exchange of single wires and a packet of wires in a transverse current of air are presented. (auth)

11728

SURVEY OF HEAT TRANSFER STUDIES BY MEANS OF BOILING WATER IN THE UNITED STATES. G. Soldaini (Centro Informazioni Studi Esperienze, Milan). Energia nucleare (Milan) 7, 159-68(1960) Mar. (In Italian)

A report is given of a trip, organized by Euratom, to many universities and nuclear laboratories in the U. S. Information gathered from specialists on problems of reactor cooling with steam—water mixtures is presented. (T.R.H.)

11729

CORRELATION OF BURNOUT HEAT-FLUX DATA AT 2000 psia. Donald W. Bell (Combustion Engineering, Inc., Windsor, Conn.). Nuclear Sci. and Eng. 7, 245-51(1960) Mar.

A condensation of this paper was previously abstracted and appears in NSA, Vol. 13, as abstract No. 17394.

11730

AN EXPERIMENT ON HEAT TRANSFER BY OVERSTABLE AND ORDINARY CONVECTION. I. R. Goroff, (Univ. of Chicago). Proc. Roy. Soc. (London) A254, 537-41(1960) Mar. 8.

A layer of mercury heated from below and subject to rotation first becomes unstable via a state of purely oscillatory motions. For a Rayleigh number, generally, much in excess of the value at which overstability sets in, the system becomes unstable for ordinary stationary convection. Chandrasekhar suggested that one might be able to detect the onset of this latter mode of instability even though it is superimposed over the overstable pattern. The present experiments confirm this expectation in a quantitative way. (auth)

Instrumentation

11731 AD-200971

Franklin Inst. Labs. for Research and Development, Philadelphia.

DETERMINATION OF ELECTRONIC SPECIFIC HEAT IN Cu—Pd ALLOYS. Final Report [for] April 1, 1956 to September 30, 1957. E. Klokholm. 52p. Contract Nonr-1887 (00). (F-A1931).

A complete description is presented of the apparatus constructed for the measurement of the electronic contribution to the specific heat in Cu—Pd alloys. Some aspects of the unusual ordered structures found in this alloy system and the nature of the origin of the anomalous decrease in resistivity with plastic deformation are also discussed. (auth)

11732 AEEW-M-29

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Establishment, Winfrith, Dorset, England.

A VEHICLE MOUNTED SCINTILLATION RATEMETER FOR ENVIRONMENTAL SURVEY. I. W. Cavell. Jan. 1960. 9p.

A method for mounting gamma survey equipment in a vehicle is described. Performance data for the equipment are given. (auth)

11733 AERE-R-3151

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A GAMMA RADIATION ALARM UNIT. K. E. G. Perry and J. E. Maddock. Nov. 1959. 16p.

An instrument was developed to give visual and aural warnings when pre-determined gamma radiation levels are exceeded. An ionization chamber is employed as the detector, with a single electrometer valve in the measuring circuit. The meter movement incorporates two photo-transistor devices that are actuated by movement of the meter needle. These provide a means of initiating the operation of alarm circuits at two radiation levels, differing by a factor of ten in magnitude. In the instrument described these levels correspond to gamma dose rates of 30 mr/hr and 300 mr/hr, but different levels can be obtained by changing the value of the electrometer valve grid resistor. In addition, allowance has been made for providing visual and audible indication at a remote point. (auth)

11734 AFCRC-TN-59-589

California. Univ., Berkeley. Electronics Research Lab.

A GASEOUS-CONDUCTION LINEAR AMPLIFIER WITH MAGNETIC FOCUSING. Scientific Report No. 5. J. N. Dukes. June 30, 1959. 58p. Contract AF19(604)-2270. (AD-229415)

An investigation is described to determine the feasibility of linear amplification by means of a cold-cathode tube with electrically independent cathodes. The characteristics of this tube indicate that linear amplification can be attained with the tube operating either as a current-gain amplifier or as a "regenerative direct-coupled" amplifier in a manner similar to a negative-resistance amplifier. The negative-resistance property of the device is also utilized for oscillator operation, and a graphical analysis of the results is made. A theory is developed, based in part on the results of particle-extraction experiments in which a modified version of the tube was used, to explain the voltage-current characteristics of the device, including the negative-resistance effects. The negative resistance observed was of the short-circuit-stable variety, which is unusual in a gaseous-conduction device. (auth)

11735 AFOSR-TR-60-25

Fribourg, Switzerland. Université.

GAS BUBBLE CHAMBER RESEARCH. Final Technical Report. 1959. 37p. Contract AF61(514)-1262.

The most promising system for the detection of the path of high-energy particles in a dense medium appeared to be a supersaturated gas—liquid system. Such a system can be obtained by dissolving a gas under pressure in a liquid and by subsequent pressure release. The development of the gas bubble chamber is described. Emphasis is put on recent developments and improvements. (W.D.M.)

11736 ARL-7-40

Ramo-Wooldridge Corp., Los Angeles. Aeronautical Research Lab.

DESCRIPTION OF THE REVOLVING MIRROR STREAK CAMERA BUILT BY THE AERONAUTICAL RESEARCH LABORATORY. Eugene B. Turner. Sept. 30, 1957. 14p.

Issued under Space Technology Labs., Inc. cover.

A revolving mirror streak camera was developed for making time-resolved studies of shock waves in shock tubes. The design is such that it can be utilized in studies of explosions, electrical discharges, etc. (W.D.M.)

11737 DEGR-78(D)

United Kingdom Atomic Energy Authority. Development and Engineering Group, Dounreay, Caithness, Scotland.

THE RESPONSE OF MONITORING FILMS TO X-RADIATION. I. Dougall. Dec. 16, 1959. 25p. BIS.

Curves are presented showing the response of Ilford PM1 and PM3 monitoring films to x ray beams of various effective energies. Sensitivity curves are also presented comparing the response of the films to x ray with the radium gamma response. (auth)

11738 HW-32708

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TEST OF HIGH STABILITY SCALER FOR THE DETERMINATION OF FISSION PRODUCTS IN REDOX URANIUM. F. P. Brauer. Aug. 10, 1954. Decl. Mar. 2, 1960. 13p. OTS.

Tests are described which were conducted with the Model 16S Scaler to determine its reliability for estimation of fission products in Redox uranium. The scaler was found to be suitable for this use. (J.R.D.)

11739 JPLAI/LS-195

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

METHODS OF MEASURING MAGNETIC FIELDS. Astronautics Information Literature Search No. 195. Edda Barber. Mar. 3, 1960. 22p. Contract NASw-6.

A literature search resulted in 134 references to methods for measuring magnetic fields from a space vehicle. Information on magnetometers using the Hall effects, peaking strips, the generator principle, and various fluxmeters are included. Information pertaining to magnetic resonance methods and moving coil and airborne magnetometers is presented. (C.J.G.)

11740 PGR-74(CA)

United Kingdom Atomic Energy Authority. Production Group, Chemical Services Dept., Capenhurst, Ches., England.

AUTOMATIC DATA RECORDING FOR ANALYTICAL INSTRUMENTS. PART I. THE ECHELLE SPECTROGRAPH. J. R. Hartley. 1960. 11p. BIS.

The development of an automatic data recording unit and its application to the Echelle spectrograph is described. The unit utilizes a commercial digital voltmeter and an electrically operated adding machine for analogue to digital conversion and the recording of the results. The performance of the unit is briefly discussed. (auth)

11741 RAE-TN-INSTN-163

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

A STRAIN GAUGE CALIBRATOR FOR TEMPERATURES UP TO 700°C. K. R. Maslen and R. W. Corbin. Aug. 1958. 30p.

A strain gage calibrator for use at temperatures up to 700°C is described. The calibrator consists essentially of a beam under 4-point loading, heated by passing a large alternating current through it. The power input is controlled by the variation of the resistance of a platinum element mounted on the beam, using thyratron trigger circuits to suppress a variable proportion of the supply wave form. The control circuit may be used for temperatures up to 660°C, but rather higher uncontrolled temperatures may be obtained. The errors of temperature and calibration are discussed, and some typical calibration results are given. (auth)

11742 SCTM-8-60(51)

Sandia Corp., Albuquerque, N. Mex.

THE ELECTRICAL BEHAVIOR OF EXPLODING WIRES. PART I. EXPERIMENTAL APPARATUS AND TECHNIQUES. F. W. Neilson and I. D. McKinney. Feb. 18, 1960. 74p. OTS.

The experimental apparatus and techniques for studying exploding wires by means of a cable discharge system are described. The cable discharge system is shown to have the advantages of more accurate and easier interpretation of results and more accurate and easier instrumentation than the more commonly used capacitor discharge systems. (auth)

11743 UMRI-03106-2-T

Michigan. Univ., Ann Arbor. Coll. of Engineering.

BEVATRON EXPERIENCE WITH A HOMOGENEOUS LUMINESCENT CHAMBER. L. W. Jones, K. Lai, R. Newsome, and M. L. Perl. Feb. 1960. 20p. Project No. 03106. Contract Nonr-1224(23).

Presented at the Seventh Scintillation Counter Sumposium, Washington, D. C., February 26, 1960.

Results and observations based on experience with a luminescent chamber at the Bevatron are reported. A luminescent chamber system was used in the pion beams over a period of five months. The space resolution, track information, and noise characteristic of the track photographs presented are marginal for reliable physics experiments. However, with increasing availability of the newer components, the luminescent chamber is ready to be seriously employed as a useful research tool. (W.D.M.)

11744 WADC-TR-59-270

Mallory (P. R.) and Co., Inc. Corporate Chemical Research Labs., Indianapolis.

RESISTORS, FIXED, ULTRA-HIGH TEMPERATURE, RADIATION RESISTANT. Period covered: July 1, 1957 to February 28, 1959. David R. Sivertsen. May 11, 1959. 45p. Project No. 4155. Contract AF33(616)-3643. (AD-215857; PB-161081). OTS.

The development of a suitable design for a one-watt resistor capable of operation at −65 to 500°C in a radiation environment for extended periods of time was continued. A high alumina material (AlSiMag 614) was found to minimize large non-uniform resistance changes occurring over uniform temperature increments to 500°C. Gold resinate terminals performed satisfactorily under severe environmental conditions. A metal oxide film containing 7.5 wt.% Sb_2O_3 and 92.5 wt.% SnO_2 was found to possess a near zero temperature coefficient of resistance over a broad temperature range and desirable electrical characteristics. Other film compositions of tin oxide and antimony oxide performed well. Flame-sprayed Al_2O_3 was found to produce a good quality insulation coating without creating undesirable effects on resistor properties. Radiation tests were performed on modified tin oxide resistors at 500°C for 1500 hours. The samples performed satisfactorily during the test and operated under electrical load for over 1000 hours. Temperature cycling, vibration, moisture, and noise tests were conducted on resistor models. No pronounced impairment of resistor performance resulted with the exception of vibration on the low resistance units. (C.J.G.)

11745 WADC-TR-59-669
Dayton, Ohio. Univ. Research Inst.
A RECORDER FOR DATA COLLECTION IN THE NEAR VICINITY OF A SEA LEVEL NUCLEAR DETONATION. Gordon W. Mills, Roger V. Hoffman, and George J. Roth. Sept. 1959. 39p. Project No. 1350. Contract AF33(616)-5008.

The feasibility of making electrical measurements within the fireball of a nuclear detonation using tape recording techniques has been established. The objective of this program was to develop a recorder (UDRI-2) which could record data within such an environment. Detailed specifications were obtained from analysis of the results of programs which had attempted to make measurements in this environment using small tape recorders. Among these specifications were operation during accelerations from any direction of 1000 g's for 2 to 3 milliseconds, reliable time reference, high over-all reliability, ease of maintenance, and flexibility. Limited evaluation of the completed recorder indicates that it has met all of the design specifications with a reasonable degree of success except for speed changes under acceleration. Speed changes of up to 50 per cent can be expected from the UDRI-2 recorder when it is subjected to a peak shock load from any direction of 1000 g's for 2 to 3 milliseconds. This slow down would not prevent successful data recording, however, since an adequate time reference, the mechanical timer, is available. Good reliability is indicated by the fact that no tape jamming or other malfunctions were observed in a total of approximately 200 acceleration and bench tests. The modular construction contributes to its ease of maintenance and makes it very flexible with respect to minor modification for particular testing jobs. The UDRI-2 recorder should therefore be capable of successfully recording data within the fireball of a sea level nuclear detonation. (auth)

11746 WAPD-RM-137
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
IRRADIATION TESTS OF MARK I PULSE INSTRUMENTS. Oliver F. Swift, William Baer, and Robert T. Bayard. July 1952. Decl. Mar. 2, 1960. 12p. Contract AT-11-1-GEN-14. OTS.

A Mark I fission counter and BF_3 proportional counter were irradiated for 600 hours at thermal neutron and gamma fluxes of 3.8×10^9 to 1.2×10^{10} neutrons/cm^2/sec. After completion of the irradiation there were essentially no changes in the operating characteristics of the instruments. (auth)

11747 SCL-T-305
SIMPLE CLOCK WITH QUARTZ TUNING FORK. (Prostye Kamertonnye Kvartzevye Chasy). L. D. Bryzzhev and U. N. Titov. Translated by Marcel I. Weinreich from Zhur. Tekh. Fiz. 24, 879-83(1954). 8p. JCL or LC.

An oscillator employing a quartz tuning fork operating with a frequency of 1000 cps is described. The power input is 0.001 w and the mean square variation is ± 0.0029 sec per day. The frequency deviation is $\pm 1.3 \times 10^{-3}$ while running. (C.J.G.)

11748
ADVANCES IN ELECTRONICS ASSOCIATED WITH NUCLEAR RESEARCH. H. W. Kendall (Stanford Univ., Calif.). Ann. Rev. Nuclear Sci. 9, 343-66(1959).

Developments in nuclear electronic instrumentation prior to March 1959 are reviewed for: semiconductor electronics, photomultipliers, fast time measurements, and instrumentation for complex experiments. The properties of transistors are discussed, and the applications of fast semiconductor diodes, transistor electronics for nuclear detectors, and transistors in computer-type circuits are reviewed. Techniques of short time resolution measurements by fast amplifiers, trigger circuits, coincidence systems, and time analyzers are discussed. (C.J.G.)

11749
NUCLEAR RADIATION AND ELECTRONIC EQUIPMENT. J. R. Crittenden (General Electric Co., Owensboro, Ky.). Applications and Ind. No. 46, 423-6(1960) Jan.

Some of the effects of radiation on electronic components which cause malfunctions are given. The case of the triode amplifier is explained through the use of equivalent circuitry. It was deduced that radiation has two primary effects on these components: to cause transient amplifier malfunction or to cause catastrophic failure through drastic component change. An analysis of the initial circuit, modified by variables caused by radiation, indicates that the radiation-induced current paths do not appreciably alter the amplifier's transfer function except at low frequencies. Suggestions for designing radiation-tolerant electronic amplifiers are as follows: keep resistance values low; use materials compatible with environment; avoid large capacitor values; keep circuits simple; and design system with these restrictions in mind. (B.O.G.)

11750
EXPERIMENTAL INVESTIGATION OF SCINTILLATION COUNTER EFFICIENCY. V. P. Bovin. Atomnaya Energ. 8, 155-8(1960) Feb. (In Russian)

The efficiency of cylindrical NaI(Tl) crystals, irradiated by point sources of Tl^{204}, Hg^{203}, Sn^{113}, Cs^{137}, and Co^{60} calibrated in an air-equivalent ionization chamber, was investigated and correlated with radium. Curves plotted for various size crystals and discrimination levels show that efficiency is determined mainly by photomultiplier performance and by the sensitivity of the scheme rather than by the dimensions of the crystals. (R.V.J.)

11751
A TRANSISTORIZED DEKATRON SCALER. Masao Ise and Yasuyuki Nakayama (Shimizu Lab., Japan). Bull. Inst. Chem. Research, Kyoto Univ. 37, 277-80(1959) July.

As an attempt to transistorize the scaling circuit, a Dekatron scaling circuit was transistorized by the use of all home-made products. Performance and operation of this new circuit are presented, although some improvements seem to be necessary. (auth)

11752
GAMMA-RAY DOSIMETRY IN AN IRRADIATION CAVITY OF THE 2000 CURIE COBALT-60 FACILITY. Sakae Shimizu, Shin Tanaka, and Yasuyuki Nakayama (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 306-18(1959) Dec.

Dose rates were calculated and measured for a 2000-c Co^{60} irradiation facility. The Fricke ferrous sulfate dosimeter, utilizing the ferrous-ferric reaction, was applied to the experimental work. A few Ag-activated phosphate glass needles were also used in parallel with the chemical dosimetry. A mathematical calculation of dose rates was performed for comparison with the experimental results. The comparison showed that experimental results were in reasonably good agreement with calculated values. The discrepancy was presumably due to the Fricke dose rates being spatially averaged values of gamma intensities in the regions occupied by the dosimeter solutions, and due to several assumptions on which the mathematical calculation was performed. Considering many conditions, the dose rate at the center of the cavity was determined with a probable error of about 5%. The Fricke chemical dosimetry was shown to be the most favorable method for the radiation fields of multikilocurie gamma sources, while the Ag-activated phosphate glass needles seemed to have some advantage over the chemical method, especially for isodose mapping of gamma fields. (auth)

11753

A PRACTICAL LEVEL DETECTOR. J. J. Arlman and H. N. L. Hoevenaar. Ingenieur, (Utrecht) 71, Ch8-9 (1959). (In Dutch)

A description of an apparatus for determing the liquid level in closed cylinders is given. The apparatus consists of a Cs^{137} source holder and a transistorized monitor to measure the gamma radiation. (Reactor Centrum, Nederland.)

11754

STABILITY OF RHENIUM/TUNGSTEN THERMOCOUPLES IN HYDROGEN ATMOSPHERES. John C. Lachman (General Electric Co., Cincinnati) and F. W. Kuether (Minneapolis-Honeywell Research Center, Hopkins, Minn.). ISA Journal 7, No. 3, 67-9(1960) Mar.

The results of tests conducted on rhenium—tungsten thermocouples to determine their stability at elevated temperatures in hydrogen are presented. The stability of the thermocouple was measured at 1000°C by reading the emf of the "as received" wire at this temperature then heating to higher temperatures. The thermocouple was allowed to return to the emf value at 1000°C and the change in temperature was recorded. The stability ranged from a $-7°C\ \Delta T$ at 1500°C to $+35°C\ \Delta T$ at 2300°C. (B.O.G.)

11755

MICROWAVE DISCHARGE CHAMBER. Shūji Fukui and Satio Hayakawa (Nagoya Univ., Japan). J. Phys. Soc. Japan 15, 532(1960) Mar.

A microwave discharge chamber is proposed as a detector of ionizing particles and its advantages over the conventional d-c chamber are pointed out: less distortion of tracks, short sensitivity time, and facility of construction. (D.L.C.)

11756

TWO THERMOCOUPLES SUITABLE FOR MEASUREMENT OF TEMPERATURES UP TO 2800°C. D. A. Davies (British Thompson-Houston Co., Ltd., Rugby, Eng.). J. Sci. Instr. 37, 15-17(1960) Jan.

The thermoelectric characteristics of two high-temperature thermocouples of tungsten/26% rhenium-tungsten and tantalum/26% rhenium-tungsten are described, and a method of determining the e.m.f. of the couples up to a temperature of 2800°C is given. In the temperature range 1000 to 2000°C, the sensitivity of the tungsten/rhenium-tungsten couple is 16.2 μV/°C and that of the tantalum/rhenium-tungsten couple is 13.6 μV/°C. The important feature of these thermocouples is their suitability for operation at much higher temperatures than existing couples, combined with a fairly high sensitivity. (auth)

11757

ION SOURCE WITH CAVITY CATHODE. A. A. Glazov and M. Kuzmiak (Joint Inst. for Nuclear Research, Dubna, USSR). Jaderna energie 6, 62(1960) Feb. (In Czech.)

A description is given of an ion source with a cold cathode which uses the Penning type discharge. The cold cathode has a cavity 400 mm deep and 3 mm in diameter. The cavity contained the high discharge current intensity ($I = 10\ A/cm^2$) under high vacuum in the discharge chamber. High ion currents are attainable during extraction parallel to the magnetic field. (C.J.G.)

11758

RIGID VINYL FILM DOSIMETER. Charles Artandi and Albert A. Stonehill (Ethicon, Inc., Somerville, N. J.). Nuclear Instr. and Methods 6, 279-82(1960) Feb. (In English)

Non-plasticized polyvinyl chloride film was found to be a reliable dosimeter in the megarad range. Methods for its use in dose measurement, measurement of electron energy (Mev), assurance of adequate ionization penetration, and measurements of source geometry are described. (auth)

11759

EFFECT OF WINDOW ABSORPTION AND SOURCE BACKING ON β-SPECTRA. B. N. Subba Rao (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci., Sec. A 51, 28-33(1960) Jan.

Estimates of the distortive effects of window absorption and backscattering from source backings on β-spectra are presented as observed in the intermediate image β-ray spectrometer. The existence of a scatter-initiating thickness is pointed out and explained. These correction factors are applied to the β-spectrum of Pm^{147} to estimate their validity. (auth)

11760

DOSIMETRY DETERMINATIONS OF GAMMA RAYS IN AN UNDERGROUND Co^{60} SOURCE. M. Sakuntala, M. F. Argus, and F. E. Ray (Univ. of Florida, Gainesville). Quart. J. Fla. Acad. Sci. 21, 131-7(1958).

To extend the usefulness of the Co^{60} source to biological experiments, gamma ray dosimetry measurements were made in the 4-inch port which is suitable for the irradiation of small experimental animals. Data is provided which permits accurate administration of radiation dosages. (auth)

11761

NUCLEAR QUADRUPOLE SPECTROMETER. E. I. Fedin and G. K. Semin (Inst. of Elementary Organic Compounds, Academy of Sciences, USSR). Radiotekh. i Elektron. 4, 127-8(1959) Jan. (In Russian)

A quadrupole resonance spectrometer with resolving power of 10^{-6} was designed. (R.V.J.)

11762

NONLINEAR THEORY OF DOUBLE-STREAM ELECTRON WAVE TUBE. PART II. RESULTS OF THE CALCULATIONS. G. F. Filimonov. Radiotekh. i Elektron. 4, 832-40(1959) May. (In Russian)

A solution was derived for non-linear equations for double-beam electron tubes, and the mechanism of amplification was investigated. The maximum efficiency factor was found as a function of the various parameters. (tr-auth)

11763

UNIVERSAL BINARY SWITCH FOR ELECTRONIC DIGITAL COMPUTERS. M. I. Elinson, D. V. Zernov, and A. M. Kharchenko. Radiotekh. i Elektron. 4, 846-51(1959) May. (In Russian)

An electronic apparatus with a flat deflected beam acting as binary switch and employing secondary emissions is described. The construction, parameters, and performance are analyzed. (R.V.J.)

11764

PULSE LENGTH DISTRIBUTION AT THE OUTPUT OF A

COINCIDENCE CIRCUIT. V. N. Dymchishin. Radiotekh. i Elektron. 4, 960-5(1959) June. (In Russian)

Pulse density and length distribution functions were developed for coincidence circuits under the action of random and periodic signals. The laws of fluctuation length distribution and of periodic signals with fluctuations acting coincidently are subject to variations which become stronger with stronger circuit output. (R.V.J.)

11765

PULSE AND OSCILLOSCOPE TECHNIQUES FOR DISCHARGE DELAY MEASUREMENTS IN DIELECTRICS. A. A. Vorobiev, G. A. Vorobiev, G. A. Mesiats, and K. K. Sonchick. Radiotekh. i Elektron. 4, 1257-9(1959) Aug. (In Russian)

A layout for developing and recording rectangular high-intensity pulses of (2 to 3) $\times 10^{-8}$ sec and with strongly synchronized evolving time is described. The techniques for developing pulses of 10^{-9} sec using the principle of over-voltage are also discussed. Various applications are described. (R.V.J.)

11766

TRANSFER CHARACTERISTIC OF PHOTOMULTIPLIERS. G. A. Vasiliev. Radiotekh. i Elektron. 4, 1377-80(1959) Aug. (In Russian)

Transition properties of photomultipliers are described. Data are presented on the performance of FEU-19, FEU-33, and FEU-1B tubes. (tr-auth)

11767

THE INDIVIDUAL DETECTION OF β PARTICLES WITH GERMANIUM AND SILICON SURFACE DIODES. H. D. Engler (Forschungslaboratorium der Siemens-Schuckertwerke AG, Erlangen, Ger.). Z. Naturforsch. 15a, 82-4 (1960) Jan. (In German)

The response of semiconductors to β particles was investigated with Ge diodes at liquid-nitrogen temperature and with Si diodes at room and liquid-nitrogen temperature. A Tl^{204} preparation was used as the β source. The spectra obtained are given. The results indicated that exact data on the β counting behavior of semiconductor diodes should be obtained with monoenergetic β particles. (J.S.R.)

11768

Walter Reed Army Medical Center. Inst. of Research, Washington, D. C.

HUMAN COUNTING FACILITY AT THE WALTER REED ARMY INSTITUTE OF RESEARCH, WALTER REED ARMY MEDICAL CENTER, WASHINGTON, D. C. Kent T. Woodward, Harry A. Claypool, and James B. Hartgering. p.565-91 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

During the period July 14 through March 31, 1959, levels of cesium-137 and potassium-40 were determined in 1278 people. Of these, 797 were selected as having no history of possible radioactive contamination through occupation, and being physically normal, without history of significant disease. Data have been prepared utilizing the quotient of the two measurements as the most reliable normalization of the results. Since cesium has the same valence as potassium, and presumably the same whole-body distribution in man, the ratio of these two measurements expressed as micromicrocuries of cesium per gram of natural potassium, eliminates weight as a variable, and makes it possible to compare levels in people regardless of their total weight, muscle mass, age, and sex. Detailed results of the data are presented graphically and are discussed. (C.H.)

11769

IMPROVEMENTS IN OR RELATING TO RADIATION DETECTORS. Anthony Antal Nemet (to Philips Electrical Industries, Ltd.). British Patent 831,526. Mar. 30, 1960.

Radiation detectors with phosphor coatings on photoconductive materials are described. The phosphor coatings may be mixtures of phosphors, and are imbedded in a plastic layer on CdS which has electrodes attached. For applications where the phosphor should decrease in efficiency with radiation energy, the use of calcium tungstate, NaI(Tl), KI(Tl), and ZnS(Ag) is suggested. Phosphors with increasing efficiency are anthracene, p-terphenyl, stilbene, diphenylacetylene, naphthalene, and tetraphenyl butadiene. (T.R.H.)

11770

A SELECTIVE ALPHA PARTICLE MONITOR. (to Atomic Energy of Canada, Ltd.). British Patent 831,545. Mar. 30, 1960.

An alpha counter is described which will count long-lived α emitters in the presence of radiation from short-lived α emitters. The device has an α detector and two counters one of which is blocked for a fixed time after each pulse from a β detector and another which counts all the pulses from the detector. The detectors are of the Geiger-Mueller type and are arranged in the same tube. The α-detector cathode is of Al and has a removable filter for collecting radioactive dust samples. (T.R.H.)

11771

NEUTRON RESPONSIVE DEVICE. (to United Kingdom Atomic Energy Authority). British Patent 831,861. Apr. 6, 1960.

A neutron detector for use in reactors is described. It consists of fissionable material applied to a bimetal switch. Neutrons cause fission which generates heat to flex the bimetal strip and close or open a circuit. (T.R.H.)

11772

HIGH CONSTANCY OF ELECTRON CURRENT OF CATHODE OF AN ION SOURCE BY APPLICATION OF A HIGHER CURRENT FREQUENCY. (to Atlas-Werke Aktiengesellschaft). German Patent DAS 1 062 832. Aug. 6, 1959. Atompraxis 6, 71(1960). (In German)

In mass spectrometers the gas to be studied is ionized by an electron current which is produced by a glowing cathode and which, for the obtention of accurate measurements, must produce a very high constancy with deviation of less than 1 per thousand. This constant electric current can only be obtained by maintenance of the heating current or temperature of the cathode, since the emission frequency of the cathode surface is permanently changed by the surrounding gas. The electron current is therefore measured and the heat current of the cathode controlled with a discharge voltage proportional to the electron current. By the application of an alternating current of more than 100 Hz, preferably in the range between 10 and several hundred kHz, to the heating of the cathode, an especially high constancy of the electron current is obtained.

11773

NEW METHOD FOR THE MANUFACTURE OF MINIATURE COUNTERS. (to Frieseke & Hoepfner G.m.b.H.). German Patent DAS 1 063 288. Aug. 13, 1959. Atompraxis 6, 71(1960). (In German)

Counters with a cathode diameter up to 5 mm are considered miniature counters. Such counters have a great potential in medical diagnostics since they can be inserted easily in body cavities without special annoyance to the patients. The design and manufacture of such a counter are described. At one end of the cathode cylinder the counter anode was sealed into a glass section. This glass section can be fused with the cathode cylinder or cemented in it. The other end of the anode was sealed into the anode wire holder which is in the form of a glass prong. This prong is sealed or cemented in a glass tube tapered at one end. The glass tube serves in the evacuation and filling of the counter. After evacuation and filling with a rare gas, the glass tube is cut off at the taper and fused air tight.

Materials Testing

11774 AERE-R-3161
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A TORUS FOR THE ARC-TESTING OF MATERIALS.
J. T. Maskrey and R. W. Barnfield. Nov. 1959. 22p. BIS.

The construction and operation of a torus for the arc-testing of materials are described. The arc behavior was found to depend on the current drawn by the specimen and the voltage applied. Vacuum heat treatment was found to reduce the conditioning period. Tests on the arcing behavior of stainless steels were conducted. (C.J.G.)

11775 DMIC-124
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
CURRENT TESTS FOR EVALUATING FRACTURE TOUGHNESS OF SHEET METALS AT HIGH STRENGTH LEVELS. J. E. Campbell and W. P. Achbach. Jan. 28, 1960. 68p. Contract AF18(600)-1375. OTS. (PB-151081)

The testing procedures that are being used to evaluate the fracture toughness of high-strength sheet metals are described. These procedures were used primarily for alloy steels, but may be used for high strength titanium and aluminum alloys and other metals. A number of testing procedures were developed for measuring the relative fracture toughness of sheet metals as a result of brittle failures in solid propellant rocket cases. These tests involve tensile loading of notched specimens; bending of flat and notched specimens; impact loading of notched specimens; bulging of unnotched, notched, and welded specimens; and combinations of tensile loading and internal pressuring of cylindrical specimens. None of these have been accepted as standard tests and correlation of test data with pressure vessel performance is very limited. (auth)

11776 SEP-218
Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.
NON-DESTRUCTIVE TESTING TECHNIQUES INVESTIGATED AT BAYSIDE FOR INSPECTION OF URANIUM SLUGS ON A PRODUCTION BASIS. H. McCullough. Oct. 15, 1953. Decl. Mar. 7, 1960. 40p. (YE53-511; DCF-4305). OTS.

Results are presented of the inspection of U slugs for cracks, pockets, inclusions and stringers by the reflectoscope and magnaflux zyglo methods. The reflectoscope is an electronic instrument which produces high-frequency electric pulses which are converted to ultrasonic mechanical vibrations. These impulses are transmitted into the material undergoing tests and travel through the material, and are reflected to the searching unit where they are reconverted to electrical impulses. These impulses are then recorded on a cathode-ray tube screen. Magnaflux zyglo is an inspection technique which consists of a low-viscosity oil which contains a fluorescent material that will penetrate porous areas or fine cracks. The slug is examined under black light and the fluorescent powder in the crevices becomes visible. (W.L.H.)

11777 AEC-tr-4025
ULTRASONIC-RADIATOR FOR TESTING OF MATERIALS WITH IMPROVED NEAR-FIELD. K. von Haselberg and J. Krautkrämer. Translated by Lydia Venters (Argonne National Lab.) from Acustica 9, 359-64(1959). 13p. JCL.

An ultrasonic tester comprising a transducer excited in the form of a Gauss-function having a variation of sound pressure along its axis which is free from oscillations is described. The polar curve of the transducer is also a Gauss function, free from nul-points and satellite peaks. The limitations due to this behavior for finite (clipped) Gauss function is illustrated with examples. (J.R.D.)

11778
NEW EDDY CURRENT TEST FOR TUBING. Byron B. Burd (Damascus Tube Co., Greenville, Penna.). Metal Progr. 77, 101-3(1960) Apr.

A method is described which allows for the nondestructive testing of tubes to determine the location of small defects. The setup contains circuitry that filters out background interference. For a wall thickness of 0.035 in., defects of 0.0020 in.^{2} are detected. (B.O.G.)

11779
IMPROVEMENTS IN CREEP TESTING MACHINES. (to Commissariat à l'Énergie Atomique). British Patent 831,579. Mar. 30, 1960.

A creep testing machine design is offered which operates in vacuum, applies stress only at test temperature, and operates for stresses in the range 10 mg/mm^2 to 3 kg/mm^2. The machine is of the upright type with heating, cooling, and evacuating means, a silica rod for temperature control, an extensometric comparator, and a load applying device. The latter consists of a lever and ball arrangement which permits applying tension at a predetermined rate by releasing the weighed balls into pans attached to lever arms. (T.R.H.)

GEOLOGY, MINERALOGY, AND METEOROLOGY

11780 AECU-4625
Coast and Geodetic Survey, Washington, D. C.
OPERATION PRE-GNOME.
SEISMIC DATA FROM NATURAL PHENOMENA AND HIGH-EXPLOSIVE TESTS NEAR CARLSBAD, NEW MEXICO. D. S. Carder, L. M. Murphy, W. K. Cloud, and T. H. Pearce. Jan. 12, 1960. 45p. [For Univ. of California, Radiation Lab., Livermore. Contract] AT(29-2)-746. OTS.

The extrapolation equations formulated prior to the Rainier Shot predicted with reasonable accuracy low-frequency displacements in potash mines and at points near the Pre-Gnome explosions (Carlsbad, New Mexico area). The equations did not predict high accelerations associated with high-frequency ground waves resulting from these explosions. Accelerations and displacements of ground motion were found to vary directly as the first power of the weight of the explosives. Both accelerations at the surface and ground amplitudes from blasts in a mine were found to attenuate as the square of the distance. Seismic wave speeds in the salt were observed to be about 14,000 fps. (C.J.G.)

11781 CEA-1269
France. Commissariat à l'Énergie Atomique, Paris and France. Électricité de France, Paris.
APPLICATION DES ISOTOPES RADIOACTIFS A L'ÉTUDE

DES MOUVEMENTS DES SÉDIMENTS ET DES GALETS DANS LES COURS D'EAU ET EN MER. (The Application of Radioactive Isotopes to the Study of Motion of Silt and Pebbles in the Rivers and in the Sea). R. Hours and P. Jaffry. 1959. 31p.

A comparative review is made of a number of techniques of labelling, immersing and detecting silts, sands, and pebbles. The influence of the burying of the active material is emphasized. The different experiments carried out are described. (auth)

11782 CNI-29
Italy. Comitato Nazionale per le Ricerche Nucleari. Centro di Studi Nucleari, Ispra.
DETERMINAZIONI DI RADIOATTIVITÀ DEI PRODOTTI DI FISSIONE SOSPESI NELL'ARIA ATMOSFERICA, ESEGUITE AL CSN—ISPRA (FEBBRAIO 1958—NOVEMBRE 1959). STIMA DEL "RENDIMENTO" DEL DISPOSITIVO DI MISURA MEDIANTE SCINTILLATORI PLASTICI ACCOPPIATI. (Radioactivity Determinations of Fission Products in the Atmospheric Air, Carried Out at the Center of Nuclear Studies of Ispra (February 1958—November 1959). Evaluation of the "Efficiency" of the Measurements Device by Means of Coupled Plastic Scintillators).
M. Forte, A. Malvicini, and C. Polvani. Dec. 1959. 34p.

The method used at the Center of Nuclear Studies of Ispra for the measurement of total radioactivity of fission products in the atmosphere is described. The relative data concerning the period February 1, 1958 to November 30, 1959, are referred. Moreover, the technique used to date nuclear explosions, some rapid discrimination methods of artificial radioactivity from natural air radioactivity and the method employed for determining the absolute efficiency of measurement of the experimental device are described. (auth)

11783 GSM-AED-95
Gt. Brit. Geological Survey and Museum London and Nigeria. Geological Survey.
THE ALBITE-RIEBECKITE-GRANITES OF NIGERIA.
R. A. MacKay and K. E. Beer. Jan. 1952. 25p., 6 illus.

The field examination and preliminary laboratory study of radioactive albite—riebeckite—granite from four Nigerian localities are presented. The granite is a medium-grained rock, white in mass color, and flecked with lustrous black prisms of riebeckite. Small vitreous honey-colored crystals of pyrochlore are present to a varying extent, but can be seen in nearly all hand specimens. Pyrochlore, a fluoniobate of Na and Ca, is the essential radioactive mineral, with minor quantities of zircon, monazite, and thorite. Radiometric assays show the pyrochlore to contain 4.1% equivalent urania. Confirmation of this determination is found in the chemical analysis which gives the following contents: 3.1% U_3O_8, 3.3% ThO_2, and 41.1% $(Nb, Ta)_2O_5$. (W.L.H.)

11784 GSM-AED-116
Gt. Brit. Geological Survey and Museum, London.
THE PETROGRAPHY OF SOME OF THE RIEBECKITE-GRANITES OF NIGERIA. K. E. Beer. 1952. 38p., 6 ills.

The mineralogy and petrology of some Nigerian granites are discussed. Special attention is given to the soda-rich albitic phases of these rocks. In addition to more common rock-forming minerals, these sodic intrusives contain in accessory amounts the rare minerals astrophyllite and pyrochlore, along with cryolite, zircon, topaz, thorite, and occasional thomsenolite. Similar rock-types, apparently forming part of the same petrographic province, have been described from the French Sudan; and comparable provinces have been met with in America and Madagascar. (auth)

11785 NP-8476
Portugal. Junta de Energia Nuclear, Lisbon.
STRUCTURE AND ORIGIN OF SOME URANIUM-BEARING VEINS IN PORTUGAL. Technical Paper No. 22.
J. Cameron. 1959. 57p.

The structure and origin of some uranium-bearing veins in Portugal are discussed. These veins are located in Serra da Estrela mountains, in the region of the Beiras, on the Iberian Peninsula. The presentation is divided into four parts representing the main districts. Characteristics of the vein structures are discussed for each district. (B.O.G.)

11786 NP-8513
Portugal. Junta de Energia Nuclear, Lisbon.
CONDIÇÕES PRELIMINARES QUE DETERMINAM O ESPAÇAMENTO ÓPTIMO DAS SONDAGENS EM ALGUNS JAZIGOS DE URÂNIO DO CONTINENTE PORTUGUÊS. Memória No. 23. (Preliminary Conditions Determining the Optimum Spacing of the Diamond Drilling in Some Uranium Deposits of the Portuguese Continent). Note No. 23.
C. Pires Lobato. 1959. 37p.

Diamond drilling has been practiced for the reconnaissance of uranium deposits in the continent, at −40, −80, and −120 meters. The spacing of the drill-holes, which generally vary between 10 and 40 meters, is determined by the preliminary conditions which refer to the morphological and metalogenical characteristics of the deposits, the dimensions of the ore bodies and the frequency of significant uranium contents. A procedure for determining optimum spacing is offered. (auth)

11787 NRL-5390
Naval Research Lab., Washington, D. C.
RADIOCHEMICAL ANALYSES OF AIR-FILTER SAMPLES COLLECTED DURING 1958. L. B. Lockhart, Jr., R. A. Baus, R. L. Patterson, Jr., and A. W. Saunders, Jr. Aug. 14, 1959. 25p. Project No. NR-571-000.

A number of radioisotopes formed in high-yield by nuclear explosions were determined quantitatively in the gross fission product conglomerate collected by air filters at sites along the 80th meridian during 1958. This period of measurement is of particular interest since, during this time, the Soviet Union carried out two intensive test programs with high-yield weapons, primarily in the Arctic, and the United States carried out one such program at the Pacific Proving Grounds. Some of the debris from tests of the latter series were tagged with W^{185}, produced through the reaction $W^{184}(n,\gamma)W^{185}$. The presence of W^{185} in one case, and its absence in another, proved that debris from two nuclear tests of the Hardtack Series crossed the Equator. Save for the period of gross contamination in the troposphere by these debris, the average age of the fission-product conglomerate in the air was consistently older in the Southern than in the Northern Hemisphere. Furthermore, the Sr^{90} content of the air has shown a general pattern of maxima in the region between 20 and 40°N and 20 and 40°S latitudes and a minimum in the equatorial region. The maximum in the north, during early 1958, averaged about 7 times that in the south. The rapid spread of radioactivity from the Hardtack and Soviet nuclear tests emphasizes that debris are not restricted to a narrow zone near the latitude of introduction. (auth)

11788 RME-1070(Rev.)
Division of Raw Materials. Denver Area Office, AEC.
PRELIMINARY DRILLING IN THE POWDER RIVER BASIN, CONVERSE, CAMPBELL, AND JOHNSON COUNTIES, WYOMING. H. E. Geslin and C. P. Bromley. June 1957. 26p. OTS.

On July 16, 1953, a diamond core-drilling program was begun in the Pumpkin Buttes area to secure geologic information. Drilling was terminated March 11, 1954, after 12 holes had been completed for a total of 5,813 feet. An investigational rotary noncore-drilling project was conducted from June 14, to September 17, 1954, in the southern part of the Powder River Basin, Campbell, Johnson, and Converse Counties, Wyoming. Drilling was done in the Pumpkin Buttes area and the Converse County area. A total of 52,267 feet was drilled and the average depth of hole was 75.3 feet. Forty-one anomalous areas in the Powder River Basin were drilled; of these, three in Converse County were found to contain possible commercial ore bodies. All of the drilling was done in the Wasatch formation of Eocene age except one locality, which was in the Fort Union formation of Paleocene age. (auth)

11789 RME-2068
Grand Junction Operations Office. Production Evaluation Div., AEC.
SOME URANIUM OCCURRENCES IN NORTHERN FERRY COUNTY, WASHINGTON. James L. Barlow. Oct. 1958. 22p. OTS.

Prospecting for uranium in northern Ferry County, Washington, was most intense during the summer months of 1955 and 1956. Exploration has diminished since, and only a few individuals are currently engaged in the prospecting and development of uranium occurrences in the area. Uraninite, uranophane, autunite, uraniferous allanite, monazite, and unidentified uranium-bearing refractory minerals occur chiefly in acid igneous rocks related to the Colville batholith of Late Mesozoic age. The principal host rocks are irregularly shaped, discontinuous pegmatites, which tend to pinch out within short distances in any direction. Distribution of the uranium-bearing minerals is erratic. The known concentrations of uranium-bearing material would require high cost selective mining and transportation. For these reasons Ferry County has not become a uranium-producing district. (auth)

11790 RME-3159
Minnesota. Univ., Minneapolis.
FINAL REPORT FOR JUNE 1949 TO THE END OF CONTRACT, JUNE 30, 1958. John W. Gruner. May 29, 1959. 39p. Contract AT(30-1)-610. OTS.

A brief account is given of geological and mineralogical investigations. The report literature is cited that contains complete descriptions of the studies. (W.L.H.)

11791 TEI-755
Geological Survey, Washington, D. C.
GEOLOGY OF DOLOMITE HILL, NEVADA TEST SITE, NYE COUNTY, NEVADA. D. D. Dickey and F. A. McKeown. Nov. 1959. 65p., 1 illus. OTS.

A summary is presented of the geologic information obtained by the U. S. Geological Survey at Dolomite Hill. The work was done for the purpose of determining to a depth of 1,200 feet the structure and chemical and physical properties of the dolomite that underlies Dolomite Hill. (W.L.H.)

11792 UCRL-5679(p.44-8)
California. Univ., Los Angeles and California Inst. of Tech., Pasadena.
THE USES OF SEISMIC SIGNALS FROM NUCLEAR EXPLOSIONS. David Griggs and Frank Press. 5p.

The location and time of each shot in the Castle Series were determined in Australia by means of earthquake seismology. This series of shots added to knowledge of propagation of seismic waves through the earth and provided information indicating that the earth's inner core has a radius from the center of 1500 km, the outer core boundary is at 3500 km, and the surface is at 6500 km. Other significant seismic observations from nuclear detonations are discussed. (C.H.)

11793 UCRL-5679(p.49-53)
California. Univ., Berkeley. [Lawrence Radiation Lab.].
SEISMOLOGICAL PROBLEMS WHICH NUCLEAR EXPLOSIONS MAY SOLVE. Perry Byerly. 5p.

Controlled nuclear explosions have much to offer to seismology in the way of interpretation of the earth's structure, in improving the location of earthquake foci, and in the correlation of wave motion with damage. (C.H.)

11794 UCRL-5679(p.54-77)
Weather Bureau, [Washington, D. C.].
THE USE OF NUCLEAR EXPLOSIVES IN METEOROLOGY. L. Machta. 24p.

It is concluded that the prospects of using nuclear explosives for weather control are not especially promising. There have been only a limited number of systematic studies to evaluate their possibilities. However, few other techniques of weather control offer any greater promise. Problems in using nuclear explosives in attempts to modify weather conditions are reviewed. It is pointed out that nuclear explosions have played an important role in meteorology through the use of fission products as tracers. (C.H.)

11795 UCRL-5679(p.78-88)
Sandia Corp., Albuquerque, N. Mex.
SOME SPECULATIONS ON THE EFFECTS OF NUCLEAR EXPLOSIONS ON HURRICANES. Jack W. Reed. 11p.

The energy transformed by condensation of water which falls from one hurricane amounted to 2×10^{26} ergs per day, or 10,000 atomic bombs per hour. Thermonuclear bombs yield an energy equivalent to that transformed in only five minutes by a mature hurricane. It is pointed out that the direct approach to tropical storm control is not reasonable since present yields cannot be expected to disperse a storm system 300 to 500 miles in diameter. However, megaton thermonuclear devices might be used for triggering some indirect or divergent system which might result in storm deflection or dissipation. Two directions for speculation on such a mechanism are discussed. Since a test would demonstrate conclusively whether or not nuclear explosions can be used to influence or destroy severe tropical storms, it is concluded that such a test should be made. (C.H.)

11796 AEC-tr-4005
ON THE USE OF NUCLEAR EXPLOSIONS FOR INDUSTRIAL PURPOSES. G. I. Pokrovskii (Pokrovskiy). Translated from Gornyĭ Zhur., No. 5, 29-32(1956). 10p. JCL or LC.

The applications of nuclear explosives for mining purposes are discussed relative to cost, effectiveness, and radiation hazards. (C.J.G.)

11797

WEEKSITE, A NEW URANIUM SILICATE FROM THE THOMAS RANGE, JUAB COUNTY, UTAH. W. F. Outerbridge, R. Meyrowitz, and A. M. Pommer (U. S. Geological Survey, Washington, D. C.) and M. H. Staatz (U. S. Geological Survey, Denver, Colo.). Am. Mineralogist 45, 39-52(1960) Jan.-Feb.

Weeksite, $K_2(UO_2)_2(Si_2O_5)_3 \cdot 4H_2O$, is a soft yellow nonfluorescent mineral with a waxy to silky luster, and it crystallizes chiefly in radiating fibrous clusters. In the Thomas Range, where it was first found, it occurs in opal veinlets in rhyolite and as replacements of pebbles in a tuffaceous conglomerate. Weeksite also has been identified from eight other localities in Pennsylvania, Wyoming, California, New Mexico, Mexico, Arizona, and Texas. Properties of weeksite are: biaxial negative 2V = about 60°; dispersion r > v, strong; α = 1.596, β = 1.603, and γ = 1.606; X = b, colorless, Y = c, pale yellow green, Z = α, and yellow green. The measured specific gravity is about 4.1. A chemical analysis of material from the Thomas Range showed: K_2O, 5.5; Na_2O, 0.7; BaO, 1.4; CaO, 1.1; UO_3, 51.5; SiO_2, 33.6; H_2O, 6.6; Al_2O_3, 0.6; and CO_2, 0.3 for a total of 101.3%. A synthetic Na analogue of weeksite showed Na_2O, 7.2; UO_3, 52.0; SiO_2, 33.9; H_2O (in part from wood) 8.1; and C (from wood), 0.3 for a total of 101.5%. Weeksite is orthorhombic, pseudotetragonal; the space group is Pnnb—D_{2h}^6 with a = 14.26 ± 0.02 A, b = 35.88 ± 0.10 Å, c = 14.20 ± 0.02 A; and a : b : c = .3974 : 1 : .3958. The cell contents are $16[K_2(UO_2)_2(Si_2O_5)_3 \cdot 4H_2O]$. The nine strongest lines of the x-ray powder pattern of weeksite are: 7.11 (10), 5.57 (9), 8.98 (8), 3.55 (7), 3.30 (7), 2.91 (6), 3.20 (5), 2.37 (5), and 2.28 (5). Those of the synthetic Na analogue are: 7.11 (10), 5.57 (9), 9.03 (8), 3.56 (7), 3.30 (7), 2.94 (6), 3.19 (5), 2.37 (5), and 2.28 (5). (auth)

11798

X-RAY DIFFRACTION STUDY OF ORIENTATION IN THE CHATTANOOGA SHALE. E. N. Silverman and Thomas F. Bates (Pennsylvania State Univ., University Park). Am. Mineralogist 45, 60-8(1960) Jan.-Feb.

An x-ray-diffraction technique was used to obtained a quantitative measure of the degree of orientation of the (0 0 1) planes of 10 A illite and mica flakes in fifty-eight samples from a drill core taken from the Chattanooga shale. Thin sections cut perpendicular to the bedding are placed on the x-ray spectrometer in such a position that, upon rotation of the section in its own plane, the geiger counter records all diffraction from mica flakes with (0 0 1) perpendicular to the plane of the section. Analysis of the resulting curve, using the Chi-square statistic divided by the area under the curve, gives an "orientation index" for each specimen which is reproducible and independent of the amount of 10 A material present. An evaluation of the data with respect to the uranium content of the samples shows that there is no significant correlation between the concentration of the element and this particular measure of the texture of the rock. This supports other evidence which indicates that the uranium was precipitated during deposition of the sediment and that the distribution of uranium has not been affected by movement of solutions during or following compaction. The technique is applicable to the study of lattice orientation of any sufficiently fine-grained mineral in natural or synthetic substances. (auth)

11799

DOVERITE, A POSSIBLE NEW YTTRIUM FLUOCARBONATE FROM DOVER, MORRIS COUNTY, NEW JERSEY. William Lee Smith, Jerome Stone, Daphne R. Ross, and Harry Levine (U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 45, 92-8(1960) Jan.-Feb.

Doverite, a possible new yttrium fluocarbonate, was found at the Scrub Oaks iron mine at Dover, Morris County, New Jersey. The mineral occurs in brownish-red aggregates mixed with xenotime, hematite, and quartz. The aggregates are irregular—some of them as large as 1 inch in diameter—and most of them have rims of bastnaesite. In parts of the mine, the doverite aggregate constitutes several per cent of the gangue. The aggregate has indices of refraction in the range from 1.700 to 1.685. It is physically inseparable from the other components of the aggregate. Hematite and doverite were leached from the aggregate leaving a residue of quartz and xenotime. From the x-ray-powder data, doverite is suggested to be an yttrian analogue of synchisite and to have a general formula $YFCO_3 \cdot CaCO_3$, the Y in the formula including several elements of the rare-earth group. The x-ray-powder pattern of doverite bears a marked similarity to that of synchisite. The powder pattern of synchisite was indexed in terms of a pseudo-orthorhombic C-centered cell with a = 4.10, b = 7.10, and c = 9.12 A. From these data the cell constants of doverite were calculated to be a = 4.07, b = 7.06, and c = 9.12 A. (auth)

11800

AUTUNITE FROM MT. SPOKANE, WASHINGTON. G. W. Leo (U. S. Geological Survey, Menlo Park, Calif.). Am. Mineralogist 45, 99-128(1960) Jan.-Feb.

Near Mt. Spokane, Washington, coarsely crystalline autunite is developed in vugs, fractures, and shear zones in granitic rock. With the exception of dispersed submicroscopic uraninite particles, autunite is the only ore mineral in the deposits. A study of associated granitic rocks revealed that apatite, the most abundant accessory constituent, was preferentially leached and corroded in mineralized zones, suggesting that it may have provided a source of lime and phosphate for the formation of autunite. Leaching may have been effected partly by meteoric water, but is considered more probably due to the action of ascending connate solutions that may also have carried uranium from unoxidized, as yet undiscovered deposits, at depth. Autunite from the Daybreak mine was studied optically, chemically, and by x-ray diffraction. The autunite is commonly zoned from light-yellow margins to dark-green or black cores, and autunite from the inner zone has a higher gravity and higher refractive indices than peripheral light material. X-ray-powder-diffraction patterns of dark and light meta-autunite formed from this autunite show no significant differences in the d spacings; however, diffraction patterns of nine zoned samples each show uraninite to be present in the dark, and absent from the light, phase. UO_2 and UO_3 determinations range from 0.66 to 0.70% and 57.9 to 58.0%, respectively, for light autunite, whereas dark autunite showed a range (in seven determinations) of UO_2 from 1.2 to 4.0%, and UO_3 from 55.1 to 58.8%. The wide range of UO_2 values in dark autunite is tentatively attributed to nonuniform distribution of discrete uraninite particles, which may also account for the dark color and higher density. Thermogravimetric and differential thermal analyses of autunite suggest discrete water losses at about 90, 145, and 220°C. The first water loss probably represents dehydration to meta-autunite II, also recognizable by marked changes in optical properties and the x-ray diffraction pattern. The form of the DTA curve above 90°C resembles that of montmorillonite, suggesting that the dehydrations at about 145 and 220°C may involve interlayer water as in montmorillonites, and the analogy with montmorillonite is further indicated by x-ray patterns of meta-autunite II heated just above these temperatures. Autunite heated to red heat shows a diffraction pattern distinct from all others. The cation exchange capacity of autunite, about 2.5 milliequivalents per 100 grams, is substantially lower than that previously reported for artificial material. (auth)

11801

X-RAY STUDY OF ALTERATION IN THE URANIUM MINERAL WYARTITE. Joan R. Clark (U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 45, 200-8 (1960) Jan.-Feb.

X-ray examinations of the mineral wyartite, assigned the chemical formula $UO_2 \cdot 6UO_3 \cdot 2CO_2 \cdot 3CaO \cdot 12\text{-}14H_2O$, show that with passage of time the mineral is altering. Up to the present time two phases, both orthorhombic, were found from repeated precession x-ray examination of a single crystal. Wyartite I (comparable to "ianthinite" described by Bignand, 1955) gave a = 11.25 ± 0.03, b = 7.09_8 ± 0.03, and c = 20.80 ± 0.06 A, with space group $P2_12_12_1\text{-}D_2^4$ (no. 19), and pseudo space-groups $P2_1cn\text{-}C_{2v}^9$ (no. 33) or $Pmcn\text{-}D_{2h}^{16}$ (no. 62). Wyartite II gave a = 11.25 ± 0.03, b = 7.09_8 ± 0.03, and c = 16.83 ± 0.05 A, with space groups $P2_1cn\text{-}C_{2v}^9$ (no. 33) or $Pmcn\text{-}D_{2h}^{16}$ (no. 62), and pseudo space-group $Pbcn\text{-}D_{2h}^{14}$ (no. 60). Indexed x-ray-powder-diffraction data for both phases are given. The alteration occurs without visible external change in the crystals, so that interpretation of chemical analyses on macroscopic samples may be open to question. The precise nature of the alteration is still unknown, although oxidation of U^{+4} to U^{+6}, with formation of uranyl ions, possibly also accompanied by some dehydration, is given as a plausible explanation. (auth)

11802

ENRICHED ORE BEST YIELD DETERMINATION IN RADIOMETRIC ENRICHMENT OF URANIUM ORES. E. D. Mal'tsev. Atomnaya Energ. 8, 121-6(1960) Feb. (In Russian)

A method is suggested for determining best yield conditions considering losses in geological prospecting S, in mining S_2, in radiometric enrichment S_3, and the hydrometallurgical limit S_4; as well as enriched ore yield γ, uranium content of ore α, uranium extraction factor in enrichment ξ, and enriched hydrometallurgical limits ξ'. The minimum uranium salt costs S_m are determined by analytical methods where S_m is expressed as the continuous function $S_m = F(S_1, S_2, S_3, S_4, \alpha, \gamma, \xi\xi')$. The approximation method, with selected experimental points, was used to find the function $\xi = f_1(\gamma)$ and $\xi' = f_2(\alpha\gamma\xi)$. Considering $S_m = f(\gamma)$ as an extreme function, the equation $dSm = 0/d\gamma$ is used for determining the best enriched ore yield at the minimum price. (tr-auth)

11803

IMPROVED FLUORIMETRIC URANIUM DETERMINATION. Nikola Getoff (Österreichische Stickstoffwerke A. G., Linz/Donau, Ger.). Atompraxis 6, 41-3(1960). (In German)

An improved fluorimetric method of determining minute quantities of uranium is described, and complete directions for analyzing phosphate-containing uranium as well as phosphate-free minerals are given. (auth)

11804

NOTES ON THE GEOCHEMISTRY OF EPITHERMAL VEINS OF PITCHBLENDE. Jacques Geffroy and Jacqueline A. Sarcia. Bull. soc. geol. France (6) 8, 531-6(1959). (In French)

Further details are given on the difference between "Limousin" type and "Erzgebirge" type uraniferous deposits, the general importance of the latter type, the relationship between a hypothesis presented and the old so-called "lateral secretion" theories, and the relationship between the great mylonites and uraniferous deposits of the "Limousin" type. (auth)

11805

GEOCHEMICAL METHODS IN PROSPECTING FOR ORES. R. Coulomb (Commissariat à l'Énergie Atomique, Paris). Énergie nucléaire 2, 27-32(1960) Jan.-Feb. (In French)

It is shown how, in the search for an element and in particular for uranium, geochemistry exploits the data of geochemical studies based on "geochemical anomalies" provoked around mineral accumulations by dispersion phenomena and demonstrated by "dispersion diagrams." The orientation of investigations varies according to whether the dispersions are primary (dispersion occurring during the mineralization) or secondary (dispersion caused by subsequent actions). (tr-auth)

11806

A RAPID PROCEDURE FOR THE SPECTROPHOTOMETRIC DETERMINATION OF URANIUM. F. Vogliotti (Sicedison, Laboratorio Ricerche, Porto Marghera, Italy). Energia nucleare (Milan) 7, 169-74(1960) Mar. (In English)

A rapid method for uranium determination is described. Minerals are decomposed by fuming with HF, HNO_3, and H_2SO_4. Uranium is then extracted by TBP as thiocyanate complex. Part of the interfering ions are first masked by EDTA, the extracted ones are washed out from TBP by a proposed solution containing KSCN, CH_3COOH, CH_3COONa, EDTA and thioglycolic acid. The uranium is then stripped from the organic phase as peruranate and determined spectrophotometrically. Over 50 ions have been taken into consideration. Among them F, V, W, Mo, Co, and Cu are tolerated in great quantities. As low as 50 ppm of U in ores can be satisfactorily determined. An analysis (sample decomposition excluded) may be run in about 10 minutes. The discussion of the results obtained follows. (auth)

11807

ON SOME GEOCHEMICAL PECULIARITIES OF RADIOACTIVE RARE-EARTH MINERALS. D. A. Mineev (Inst. of Mineralogy, Geochemistry and Crystal Chemistry of Rare Elements, Academy of Sciences, Moscow). Geokhimiya No. 2, 131-8(1960). (In Russian)

A qualitative paragenetic bond of Th with TR_{Ce} (Ce content of rare earths) and of U with TR_Y (U content of rare earths) was determined. Some analogy in the evolution of the ratios $\Sigma TR_{Ce}/\Sigma TR_Y$ and Th/U in the process of mineral formation was observed. The dependence between the content of corresponding rare-earth and radioactive elements was quantitatively demonstrated on the example of the composition change of the individual minerals. The practical value of the correlation of the ratios $\Sigma TR_{Ce}/\Sigma TR_Y$ and Th/U in various mineralogical substances is discussed. (auth)

11808

DETERMINATION OF ZIRCONIUM IN ALLUVIAL SANDS. R. Petcov and G. Raducan. Rev. chim. (Bucharest) 9, 459 (1958). (Translated from Referat. Zhur. Khim. No. 17, 1959, abstract No. 60507)

A sample of the analyzed sand (1 to 2 gr) is heated with 30 ml of a mixture (1:10) of H_2SO_4 and HF, the residue is treated 3 to 4 times with water with evaporation to dryness, then calcined and fused with 10 gr of molten borax. After cooling the melt is dissolved in 150 ml HCl (1:5), boiled and diluted with water up to 250 ml volume. In the gravimetrical determination of Zn, to 100 ml of the obtained solution are added 10 ml of conc. HCl and 50 ml of 16% hydrocyanic acid, keeping the solution for 30 minutes on a steam bath at 85°C. The precipitated residue obtained after cooling is filtered out on a filtering crucible No. 3, washed first with 2% HCl solution that contains 5% of hydrocyanic acid, and then 2 to 3 times with ethanol, and dried at 110 to 120°C. The calculating factor for ZrO_2 is equal to 1772. For the photometric determination of Zr, from the primary solution (obtained in dissolving the raw sample) two 10 ml samples are taken to each of them, 2 ml of 25% solution of $NH_2OH \cdot HCl$ are added. The samples are then heated for 2.3 [sic] minutes on a water bath (in so doing the samples become colorless), cooled, followed by the addition of 2.5 ml of 10% HCl. Then to one of the samples is added 1 ml of 0.05 M solution of complexon III (for the masking of Zr). 5 ml of 0.1% solution or alizarine red are then added to both samples followed by keeping samples on a water bath for 3 minutes, cooling, diluting with water up to 50 ml volume, and conducting photometric test at 570 mμ, employing the sample containing complexon III as a reference sample.

11809

SPECTRAL DETERMINATION OF ZIRCONIUM IN ALLUVIAL SANDS. A. Banu and M. Sterghiu. Rev. chim. (Bucharest) 9, 461-3(1958). (Translated from Referat. Zhur. Khim. No. 17, 1959, abstract No. 60508)

The finely ground sample (1 to 2 gr) is mixed with KOH and KNO_3 and fused in a nickel crucible. The melt is dissolved in HCl (1 : 1) and diluted with water up to 500 ml volume. Several drops of the obtained solution are placed on carbon electrodes and induce spectra in the discharge of a condensed spark at a capacity of 1500 nf, self-induction of 0.02 mgn, and current of 1.4 a. For the photographing of spectra, a medium quartz spectrograph ISP-22 is employed. The analysis is conducted in accordance with the method of additions using a graduated plot in the I_1/I_2 coordinates C following the lines Zr 3273.04 to Ti 3239.03 A. Due to low concentrations of Zr in the solution present between the values of I_1/I_2 and C, the direct proportionality is observed. The sensitivity of the method is $2.5 \cdot 10^{-5}$ gr/ml Zr. An absolute error, characterizing the reproducibility on the analysis results, comprises ±0.03%.

11810

TRITIUM MEASUREMENTS ON IRON METEORITES. K. Goebel and P. Schmidlin (European Organization for Nuclear Research, Geneva). Z. Naturforsch. 15a, 79-82 (1960) Jan. (In German)

The tritium content of seven iron meteorites, five chondrites and two achondrites, was determined by the usual method of fusion of the sample in high vacuum and pumping the hydrogen obtained into a counter tube. The values obtained are tabulated and show that the ratio of the number of T decays per minute and gram to the time of fall is usually between 0.5 and 0.7. From the cross sections from the formation of tritium in the various elements of the meteorite, the nucleon and particle current of cosmic radiation in the universe is calculated and the results are tabulated. The probable radiation age of the meteorites is discussed. (J.S.R.)

11811

Weather Bureau, Washington, D. C.

[ROLE OF ATMOSPHERE IN FALL-OUT PROBLEM]. STATEMENT OF DR. LESTER MACHTA. p.127-39 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

The role of the atmosphere in fall-out deposition is discussed. General principles are reviewed and applied to the patterns of a hypothetical attack. (C.H.)

11812

California. Univ., Richmond. Inst. of Engineering Research.

THE EFFECT OF TERRAIN AND NATURAL WEATHERING FACTORS ON FALLOUT DEPOSITS. STATEMENT OF MYRON B. HAWKINS. p.168-86 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Current information is summarized on fall-out deposition and accumulation. The natural forces of prime importance in the migration of fall-out appear to be wind, rain, and waterflow. The action of each is discussed. (C.H.)

11813

Naval Radiological Defense Lab., San Francisco.

BASIC PROPERTIES AND EFFECTS OF RADIOACTIVE FALLOUT. FACTORS MODIFYING THE BEHAVIOR OF DEPOSITED CONTAMINANTS. Sanford Baumm. p.187-9 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Factors which modify the behavior of deposited fall-out contamination are discussed. It is pointed out that the radioactivity is modified by the roughness of the terrain and by the fact that deposited fall-out may not remain fixed. Wind, rain, snow, and size of particles as well as both natural and man-made objects can affect the deposition pattern. After fall-out particles reach the ground they may be washed into the ground or carried away by runoff. In general, the effect of weather is to reduce the predicted intensities. Results are reported from experiments to determine the change in hazard caused by gross differences in natural terrain. The role of vegetation, trees, and buildings on reduction of predicted fall-out levels is discussed. (C.H.)

11814

Geological Survey, Washington, D. C.

PHOTOGEOLOGIC MAP OF THE CROOKS CREEK SE QUADRANGLE FREMONT AND SWEETWATER COUNTIES, WYOMING. Miscellaneous Geologic Investigations Map I-304. Charles H. Marshall. 1959. 1p. $0.50(USGS)

11815

Geological Survey, Washington, D. C.

PHOTOGEOLOGIC MAP OF THE CROOKS CREEK SW QUADRANGLE FREMONT AND SWEETWATER COUNTIES, WYOMING. Miscellaneous Geologic Investigations Map I-305. Charles H. Marshall. 1959. 1p. $0.50(USGS)

11816

Geological Survey, Washington, D. C.

PHOTOGEOLOGIC MAP OF THE SPLIT ROCK SW QUADRANGLE FREMONT AND SWEETWATER COUNTIES, WYOMING. Miscellaneous Geologic Investigations Map I-306. Charles H. Marshall. 1959. 1p. $0.50(USGS)

11817

Geological Survey, Washington, D. C.

URANIUM IN COAL IN THE WESTERN UNITED STATES. Geological Survey Bulletin 1055. 350p., 46 illus. GPO.

Extensive investigations were made of the occurrence and distribution of U in coal and related carbonaceous materials throughout large areas in the Western U.S. By use of portable Geiger and scintillation counters and car-borne scintillation equipment, hundreds of exposures of coal were tested for radioactivity, and samples were collected for chemical and spectrographic analysis. Subsequently, exploratory core-drilling was carried out in several coal-bearing areas in North Dakota, South Dakota, Wyoming, and Idaho to determine the U content of coal beds below the surface. These investigations show that several large coal deposits in the Tertiary basins of the Rocky Mountain and the Great Plains regions contain very low concentrations of U. The U content of the coal in these deposits is not uniform but ranges from ~0.005 to 0.02%. (W.L.H.)

11818
SPECTROGRAPHIC DETERMINATION OF URANIUM IN ORES AND THE PRODUCTS OBTAINED BY TREATMENT OF THESE ORES. N. G. Morozova. p.41-8 of "Soviet Research in Analytical Chemistry of Uranium, 1955-1957. Chemistry Collection Series." (In English Translation). New York, Consultants Bureau, Inc., 1959. $10.00.

This paper was previously abstracted from the original language and appears in NSA, Volume 11, as abstract No. 9275.

11819
DETERMINATION OF URANIUM IN ACCESSORY MINERALS. I. E. Starik, L. Ya. Atrashenok, and A. Ya. Krylov (Khlopin Radium Inst., Academy of Sciences, USSR). p.49-51 of "Soviet Research in Analytical Chemistry of Uranium, 1955-1957. Chemistry Collection Series." (In English Translation). New York, Consultants Bureau, Inc., 1959. $10.00.

This paper was previously abstracted from the original language and appears in NSA, Volume 11, as abstract No. 3776.

11820
A SPECTROGRAPHIC METHOD OF DETERMINING SCANDIUM IN MINERALS, ORES AND PROCESS PRODUCTS. S. M. Solodovnik, A. K. Rusanov, and A. I. Kondrashina (State Scientific Research Inst. of Rare Metals, Moscow). p.256-9 of "Soviet Research on the Lanthanide and Actinide Elements, 1949-1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10468.

11821
AN IMPROVED PROCESS FOR THE CAUSTIC SODA DECOMPOSITION OF MONAZITE. G. A. Meerson, G. E. Kaplan, and T. A. Uspenskaya (Uspenskaia). p.306-8 of "Soviet Research on the Lanthanide and Actinide Elements, 1949-1957. Part II. Analytical and Separation Chemistry." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $20.00.

The decomposition of a monazite concentrate by a caustic soda solution in heated ball mills resulted in the almost complete extraction of the mineral (by a two-stage process) without the need for pulverization. The consumption of caustic soda was about half of what is required for the ordinary method. (C.J.G.)

11822
SOVIET RESEARCH ON THE LANTHANIDE AND ACTINIDE ELEMENTS, 1949-1957. PART IV. GEOLOGY. Chemistry Collection Series. In English Translation. New York, Consultants Bureau, Inc., [1959]. p.549-608. $7.50.

A review of Russian research on the geology of the lanthanide and actinide elements performed during the period 1949 to 1957 is given. Abstracts were prepared for all the papers presented. (C.J.G.)

11823
QUANTITATIVE RADIOMETRIC MEASUREMENT OF RADIOACTIVE ORES IN THE NATURAL OCCURRENCE. V. L. Shashkin. p.585-90 of "Soviet Research on the Lanthanide and Actinide Elements, 1949-1957. Part IV. Geology." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $7.50.

The measurement of gamma radiation from radioactive ores in the natural deposit—directly in the face of a mine working or in a bore hole—permits determination of the radioactive element content in ores without collecting test samples and without chemical analyses. The accuracy of quantitative measurement by gamma rays depends to a considerable degree on correct interpretation of the spectral content of the gamma radiation measured. The gamma spectra of radioactive ores is determined by the process of radiation dispersion and depends on the content of the ore. The gamma intensity registered by an ore seam depends on the cathode material of the counter (tungsten, copper, graphite) as a consequence of the difference in spectral sensitivity of various counters. The relationship of gamma intensity during measurement with a Geiger counter with various cathodes permits a characterization of the spectral composition of the ore's gamma radiation. In order to express the results in general units, microroentgens per hour, radiometers must be calibrated with an exact standard, but the calibration method does not exclude the radiometer reading dependence on the spectral sensitivity of the counters. The important conversion coefficients for connecting gamma intensity with the content of radioactive elements in ore are determined. During measurements in borings, low energy backscattering is of great importance. (auth)

11824
QUANTITATIVE RADIOMETRIC MEASUREMENTS OF RADIOACTIVE ORES IN NATURAL DEPOSITS. PART II. V. L. Shashkin. p.591-6 of "Soviet Research on the Lanthanide and Actinide Elements, 1949-1957. Part IV. Geology." (In English Translation). New York, Consultants Bureau, Inc., [1959]. $7.50

A description is given of a method of radiometric sampling of radioactive ores and of a method of interpreting the results of tests of bore-holes. (auth)

HEALTH AND SAFETY INCLUDING DOSIMETRY

11825 A/AC.82/G/L.314
New Zealand. Dept. of Scientific and Industrial Research. Div. of Nuclear Sciences, Lower Hutt.
EFFECTS OF ATOMIC RADIATION. T. A. Rafter. Nov. 19, 1959. 6p.

Data are summarized from measurements made in New Zealand between 1957 and 1959 of contamination of the ground by strontium-90 and cesium-137; determinations of carbon-14 relating to seasonal and latitude concentration variations in the atmosphere, seasonal and latitude variations in ocean concentration, exchange with ocean carbonate, and distribution in biological material; measurements of gross beta activity deposition in rainwater; and the tritium content of natural waters. (C.H.)

11826 AERE-R-3127
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England and United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
RADIOSTRONTIUM AND RADIOCAESIUM IN DRINKING

WATER IN THE UNITED KINGDOM. Results up to Mid 1959. R. N. Crooks, R. G. D. Osmond, M. J. Owers, E. M. R. Fisher, and T. W. Evett. Dec. 1959. 9p. BIS.

The determination of Sr^{89}, Sr^{90}, and Cs^{137} in samples of drinking water from a number of supply undertakings in the United Kingdom has continued. In the first six months of 1959 the concentration of Sr^{90} in supplies derived from rivers and lakes was in the region of 0.5 $\mu\mu$c/l and 1 $\mu\mu$c/l, respectively. The concentration of both Sr^{90} and Cs^{137} in these surface water supplies has approximately doubled compared with the corresponding period in 1958. The activity of well water remains very low. Until the Sr and Cs concentration in food during 1959 has been published, no estimate of the relative significance to the population of these increases can be made. (auth)

11827 CEA-1152

France. Commissariat à l'Énergie Atomique, Paris.
SORBONNES BLINDEES POUR MANIPULATIONS RADIOACTIVES. (Shielded Enclosure for Handling Radioactive Material.) H. Laurent and J. M. Courouble. Mar. 1959. 19p.

Two enclosures linked by an air-lock are described. They are designed for the safe handling of 5 curies of 0.3 to 0.5 Mev γ emitters, and each is composed of a semi-tight case, ventilated, clad in 80-mm steel plate, and suited for a wide variety of physics and chemistry operations. The equipment required for any given operation can be installed in the shortest possible time, access to the enclosure being via a removable front. Visual control is assured through a lead-glass screen. Each enclosure is fitted with a master-slave manipulator, Argonne model 7, and plugs and air-locks are provided for the introduction of liquids and solids. (auth)

11828 CF-BP-5006/42

Gt. Brit. Div. of Atomic Energy (Production), Risley, Lancs, England.
THE BACKGROUND BETA SURVEY OF THE WINDSCALE AREA. G. E. Buckley and R. T. Brunskill. Sept. 4, 1950. 39p.

Measurements of the total natural β active content of the atmosphere in the Windscale Area were made. The variation of beta activity in the atmosphere due to changes in the atmospheric turbulence and general meteorological conditions was much greater than variation due to changes of location. The total beta activity in the atmosphere was found to vary from 7 to 343 × 10^{-12} curies/meter^3 with a mean value of 54 × 10^{-12} curies/meter^3. The results of total β atmospheric activity obtained enables a prediction to a factor of ±2 the probable value of total β atmospheric activity at any given time. Results show that it will not be possible to measure accurately concentrations of β active effluent in the atmosphere of less than 5 × 10^{-10} curies/meter^3 if the β activity has a half life less than 3 hours. For β active effluent in the atmosphere with a half life greater than 24 hours concentrations down to 10^{-12} curies/meter^3 can be measured. (auth)

11829 HW-31522

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SURFACE DOSAGE RATE STUDIES OF TASK III FEED MATERIAL. G. L. Helgeson. Apr. 20, 1954. Decl. Mar. 15, 1960. 25p. Contract W-31-109-Eng-52. OTS.

The surface dosage rates from two 450-g samples of pink-colored and blue-colored plutonium fluoride powder contained in Plexiglas jars with one-fourth inch thick walls were determined. From this it has been possible to calculate the surface dosage rate through neoprene and surgical gloves and through plastic gloves, or bags, and surgical gloves. It is strongly recommended that techniques used in handling plutonium fluoride powder be carefully evaluated. (auth)

11830 IDO-10035

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
NUCLEAR INCIDENT AT THE IDAHO CHEMICAL PROCESSING PLANT ON OCTOBER 16, 1959. William L. Ginkel, C. Wayne Bills, Aubrey O. Dodd, Klem K. Kennedy, and Fred H. Tingey. Feb. 15, 1960. 97p. OTS.

A nuclear incident involving uranium process solutions occurred at the Idaho Chemical Processing Plant, National Reactor Testing Station, on October 16, 1959. A report is presented in which the events leading to the incident are discussed and the consequences of the nuclear excursion are described including radioactive contamination and personnel exposures. The findings and recommendations of the committee are given and additional data on operational background, health physics, and material balance aspects of the incident are reported. (auth)

11831 NBS-TN-29

National Bureau of Standards, Washington, D. C.
PHOTOGRAPHIC DOSIMETRY AT TOTAL EXPOSURE LEVELS BELOW 20 mr. Margarete Ehrlich and William L. McLaughlin. Oct. 1959. 25p. (PB-151388). OTS.

Assemblies of commercial photographic material sandwiched between two plastic scintillators can be used to measure high-energy x- or gamma-ray exposures down to 1 mr and less. The energy dependence of the assemblies' response is much less than that of a conventional photographic dosimeter, in some instances allowing an exposure interpretation with an accuracy of ± 25 percent over the energy range from about 0.1 Mev to 1.25 Mev. However, low-intensity reciprocity failure limits the range of applicability of the system. Conventional photographic dosimeters, not incorporating scintillators, are usually preferable for routine personnel dosimetry. By extending the monitoring period, it may be possible to avoid personnel dosimetry below 20 mr entirely. However, by doing this, one introduces additional difficulties because of instabilities in the photographic image. In some instances, an increase in effective emulsion thickness, achieved by using stacks of identical films, may lead to an increase in emulsion sensitivity sufficient to extend the useful range of a film badge well below 20 mr, without the use of a scintillator. (auth)

11832 NRL-5448

Naval Research Lab., Washington, D. C.
CALCULATION OF ABSORBED DOSE. C. H. Cheek and V. J. Linnenbom. Dec. 9, 1959. 34p.

Equations and tabular data are presented for calculating the absorbed dose in rads when the field conditions of exposure to radiation are known. The elements considered here are those most commonly found in low-Z organic materials, such as plastics, elastomers, lubricants, and insulating materials. The types of radiation considered are gamma radiation, fast monoergic electron beams, and neutrons having a spectrum of energies. Examples are included to illustrate application of the formulas. (auth)

11833 NRL-Memo-922

Naval Research Lab., Washington, D. C.
SPECTROSCOPIC STUDIES OF NUCLEAR SUBMARINE ATMOSPHERES. II. INFRARED ANALYSIS OF MAJOR GASEOUS CONTAMINANTS. Raymond A. Saunders. May 1959. 11p. Project NR 477-000.

Infrared spectral analyses were made of compressed submarine air samples taken aboard the USS SEAWOLF during the cruise covering the period 3–26 November, 1958. Contaminants detected in the gross samples include no carbon monoxide, carbon dioxide, water vapor, Freon-12, methane, methyl alcohol, acetylene and nitrous oxide. Each of these contaminants was measured quantitatively and found to be well below permissible limits. The way in which the concentration of each of these contaminants is effected by the operation of the Desomatic burner is discussed. (auth)

11834 NYO-2980
Convair, Fort Worth, Tex.
SAFETY ANALYSIS OF ENRICHED URANIUM PROCESSING. A Study of the Possible Consequences of Nuclear Accidents in Licensed Plants Processing Unirradiated Enriched Uranium. H. T. Williams, J. W. McWhirter, A. H. Chura, E. H. Wissler, R. E. Fields, and M. C. Lawrence. Mar. 18, 1960. 199p. Contract AT(30-1)-2271. OTS.

Results are presented of a study conducted to evaluate the potential hazards involved in the processing of unirradiated, enriched uranium in licensed commercial plants. The potential sources of nuclear accidents are examined and the range of excursion magnitudes to be expected from such accidents determined. The possible consequences are estimated in terms of the extent of the radiation hazards from direct nuclear radiation and the dispersal of radioactive fission products. (auth)

11835 RM-2006(RAND)
RAND Corp., Santa Monica, Calif.
RATE OF FALL THROUGH THE ATMOSPHERE OF IRREGULARLY SHAPED PARTICLES. R. R. Rapp and J. D. Sartor. Nov. 1, 1957. 18p. (AFSWP-1061; AD-150665)

Results are presented of several laboratory tests conducted on simulated fall-out particles. These measurements were made in order to clarify the law of fall of irregular particles in the range of Reynolds numbers from 0.01 to 10.0. The results of the experiments are presented in tabular form, and are compared graphically with the theoretical approximation to the rate of fall of spheres, and with the accepted curve for spheres. (auth)

11836 UCRL-8701
California. Univ., Berkeley. Lawrence Radiation Lab.
AUTOMATIC READER FOR AIR-MONITORING FILTER PAPER. M. D. Thaxter and Thomas Taussig. Sept. 28, 1959. 14p. Contract W-7405-eng-48. OTS.

An automatic reader was developed for scanning 4 × 9-in. filter papers from systems that monitor particulate airborne activity. Paper tape shows alpha and beta-gamma activities, together with counting times and identifying data, for any samples exceeding a predetermined value a special indicator mark is added. (auth)

11837 USNRDL-TR-277
Naval Radiological Defense Lab., San Francisco.
STATUS OF RADIOLOGICALLY PROTECTIVE COATINGS FOR LAND TARGET SURFACES. W. L. Owen. Nov. 13, 1958. 54p.

The results of five field tests were reviewed to ascertain the contribution of protective coatings toward improving the contamination-decontamination characteristics of standard building material. Decontamination effectiveness values are presented for several procedures used in the removal of dry, slurry, and wet contaminants. The increase in effectiveness due to the presence of protective coatings is then measured, and those coatings which contributed significantly are noted. Criteria are defined which will govern the future development of more effective coatings. (auth)

11838 WADC-TR-60-141
Bureau of Mines.
RESEARCH ON THE HAZARDS ASSOCIATED WITH THE PRODUCTION AND HANDLING OF LIQUID HYDROGEN. Period covered: January 1958 to December 1959. Michael G. Zabetakis and David S. Burgess. Dec. 1959. 86p. Project No. 8 (22-3151). Contract AF33(616)-58-5.

The vaporization of liquid hydrogen from a surface is treated as a problem in heat transfer theory. Two extreme cases are briefly considered: (1) the transfer of heat occurs at constant temperature drop between the boiling liquid and the hot surface, and (2) the transfer of heat is limited by the rate at which it can flow to the surface through a hot insulating medium. The available data indicate that case (1) is applicable when vaporizing from a conducting surface and initially, when vaporizing from an insulating medium; case (2) is applicable after initial flash vaporization has occurred from the insulating medium. The vaporization rate determines in part the rate at which flammable hydrogen vapor-air mixtures are formed above a spill area. However, the rate at which heat is transferred to the vapor is also important as is the rate at which air is brought in contact with the vapor. Accordingly, the distribution of flammable mixtures above a spill area was determined experimentally. In general, flammable mixtures were found to be both above and within the visible vapor cloud. The hazards associated with the ignition of hydrogen vapor-air mixtures above a liquid hydrogen spill area were determined by (1) igniting the vapors above a dewar and (2) igniting the vapor-air mixtures above a spill area at various times following spillage of various quantities of liquid to 90 liters. Flame height and width measurements were made from motion pictures of the resultant flames. In addition, radiant energy and overpressure measurements were made at various distances from the flame. While the flame radiation was found to represent an appreciable amount of the available energy, the overpressure produced by the rapid combustion of hydrogen above a spill area was quite small. Burning rate measurements were conducted on pools of various liquid fuels including hydrogen. These were used to correlate burning rate with the heat feed-back to a pool to maintain steady vaporization and combustion. Finally, the results of this study were used to compile a table of distances for the storage of liquid hydrogen and outline emergency procedures for the protection of personnel and equipment when an accidental spillage of hydrogen occurs. (auth)

11839 WT-1120
Naval Medical Research Inst., Bethesda, Md.
RADIATION ENERGY ABSORBED BY HUMAN PHANTOMS IN A FISSION FALLOUT FIELD. George W. Imirie, Jr., and Robert Sharp. [1955]. Decl. Sept. 19, 1959. 60p. Project 2.6 [of] OPERATION TEAPOT. OTS.

Actual methods used to evaluate total radiation doses received by personnel operating in residual fall-out fields are questionable, due to the limitations of present radiac monitoring equipment. The military, in order to plan better operations in nuclear warfare, must have accurate knowledge of the hazards to be encountered. The planned objectives are aimed at evaluating the total energy absorbed, pointing out the inadequacies of present field instruments and the existence of an additional hazard to personnel. Phantoms, resembling humans and made of tissue equivalent materials, were placed in prone and upright positions in a fall-out field. Measurements of dose received were taken over the surface and at several internal locations corresponding to the positions of vital organs. The presence of a soft component, strongly indicative of beta radiation, was found which gave a surface dose, in many cases, 50 times the average internal dose for a man lying prone. This factor can be reduced approximately 50 percent by brushing the ground, but this apparently has little effect on the internal dose. The upright man in such a field received doses differing by a factor of eight between feet and head. Although the internal doses agreed favorably with standard radiac equipment, the surface dose was found to be significantly greater. It is concluded that a fall-out field delivers a large dose of absorbed energy to the body, which is not usually measured. Further study is required to determine the biological hazard of the unmeasured components. (auth)

11840 JPRS-3044
SELECTED SOVIET MILITARY TRANSLATIONS NO. 10. Mar. 9, 1960. 91p. LC.

Radiation Reconnaissance. Methods of radiation reconnaissance for the determination of radiation in contaminated areas and marking the bounds of the contaminated area are discussed. Also discussed are means for monitoring air, water, soil, and foodstuffs. The equipment used for the monitoring, such as protective clothing and radiation detection instruments, are described. Dangers of Testing Nuclear Weapons. Two basic questions connected with the carrying out of nuclear tests are examined. First, how the air, soil, and water are poisoned by the radioactive products of the explosion, and the danger this represents for mankind. Second, how nuclear explosions are detected, and what methods may be used to check on the general curtailment of nuclear tests. Radiological Processing Aboard Ship. The effect of external and internal radiation on organisms is discussed. Methods for protecting personnel against radiation and methods of decontamination of naval vessels and personnel are presented. Atomic Power Units on Ships. A general discussion is presented on the uses of reactors in naval vessels. (W.L.H.)

11841
FALLOUT β-ACTIVITY IN PRECIPITATION. Rolf Björnerstedt and Kerstin Löw (Research Inst. of National Defence, Stockholm). Arkiv Fysik 16, 315-19(1960). (In English)

The results of studies on fallout β-activity monitoring of rainwater and snow in Sweden for the period 1953 to 1957 are reviewed. (C.J.G.)

11842
THE INCREASE OF γ-RADIATION FROM THE GROUND IN SWEDEN (1950-1959) CAUSED BY FALLOUT FROM NUCLEAR WEAPON TESTS. Rolf M. Sievert (Inst. of Radiophysics, Stockholm). Arkiv Fysik 16, 349-52(1960). (In English)

Graphs are presented showing the increase of γ-radiation from the ground in Sweden for the period of 1950 to 1959. (C.J.G.)

11843
ARTIFICIAL RADIOACTIVITY OF THE AIR. J.-Cl. Philippot. Bull. inform. sci. et tech. (Paris) No. 36, 25-6 (1960) Jan. (In French)

The quantity of artificial β activity present in the air at soil level was measured in 1959 in ten sections of France. The monthly results are tabulated. The variations of radioactivity with altitude are also determined. (J.S.R.)

11844
DOSIMETRY FOR RADIATION PROTECTION PURPOSES. W. J. Oosterkamp. Chem. Weekblad 55, 371-4(1959). (In Dutch)

A description of dosimetric quantities and units is given. A description of instruments to measure dose rate for site monitoring is contained and the accumulated dose for personnel is discussed. (Reactor Centrum Nederland).

11845
DOSIMETRY FOR RADIATION PROTECTION PURPOSES. J. H. Spaa. Chem. Weekblad 55, 381-7(1959). (In Dutch)

A review is given of the principles and methods employed in the dosimetry of contaminated air and water is given. (Reactor Centrum Nederland).

11846
THE SAFE MANIPULATION OF 2,000 CURIES OF COBALT-60 IN A TEMPORARY ENCLOSURE. W. R. McMurray (National Physical Research Lab., Pretoria). Ind. Rev. Africa 11, No. 7, 80-5(1960) Jan.

The method used in the transfer of a 2,000-c Co^{60} source from its shipping cask to a radiation therapy unit at Pretoria, South Africa, General Hospital is given. The method entailed the construction of a shield to protect the personnel during the transfer and a viewing system to observe the transfer procedure. The shield consisted of 3.5-ft front and 12-in. side walls made from 6 by 6 in. concrete blocks; there was no shielding across the top of the enclosure. Two viewing systems were installed: (1) three mirrors serving effectively as a periscope and (2) a closed-circuit television system. The transfer operation took 20 minutes, and the total exposure dose received by operating personnel was 45 mr. (B.O.G.)

11847
RADIATION DOSIMETRY USING PLASTIC MATERIALS. I. DETERMINATION OF DOSE POINT BY POINT IN A VOLUME IRRADIATED WITH GAMMA RAYS FROM RADIOCOBALT. M. Lefort and X. Tarrago (Université, Paris). Intern. J. Appl. Radiation and Isotopes 7, 323-6 (1960) Feb. (In French)

The radiation induced absorption at 3000 A in transparent methyl methacrylate is used for measuring radiation doses at each point of a volume irradiated by six radiocobalt sources. Results are given on the uniformity of dose in this volume. (auth)

11848
EXPERIMENTAL MODEL FOR CHEMICAL RADIATION PROTECTION. REPORT I: INHIBITION OF THE BASIC PROCESSES OF BIOLOGICAL RADIATION EFFECTS BY CYSTEINE. Kurt Flemming (Universität, Greifswald, Ger.). Strahlentherapie 111, 339-58(1960) Mar. (In German)

Radiation of erythrocytes by x rays and by ultraviolet light leads to an increase in the permeability of the membrane of the erythrocytes, which manifests itself in a hemolysis. This radiological hemolysis is preceded by a swelling of the erythrocytes, and the first sign of the increase in the permeability of the membrane in the more concentrated exchange of sodium and potassium between the interior of the cell and the surrounding fluid. All these radiation damages will be prohibited in the presence of cysteine. One can almost come to the conclusion, that the disturbances in the permeability of the cell membrane produced by radiation, represent a biological attacking-point for the chemical radiation protection. The disturbances in the permeability of the cell found in the erythrocytes after radiation, are connected originally in all probability with processes of dehydration, which are carried out on the albumen of the erythrocytic membrane during radiation. The indication for this causal connection explains itself in the comparison of the darkening of the albumen solutions in vitro with similar microscopically visible changes of the membrane structure. A further indication can be shown through the fact, that the coagulated albumen itself changes similarly through radiation, and the radiation hemolysis by change of the ionic medium. Furthermore the same prohibition of both processes through cysteine, can also be regarded as an indication for the above connection, which simultaneously confirms the idea, that the attacking-point of drugs used for purposes of radiation protection is to be found in the long run in the denaturing effect of the rays upon the cell-protein. (auth)

11849

Office of Civil and Defense Mobilization, [Battle Creek, Mich.].

[FALL-OUT DISTRIBUTION IN U.S. AFTER NUCLEAR ATTACK]. TESTIMONY OF CHARLES K. SHAFER. p.43-55 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Estimates are presented of fall-out conditions expected following a postulated nuclear attack under assumed weather conditions. The radiation doses to people in the fall-out zones are estimated. It is shown that the intensity of the radiation decreases with time but the radiation dose accumulates with the passage of time due to the continued fall-out and build-up on the ground. At a cost of about $150 to $200 per dwelling a fall-out shelter can be built which will protect from fall-out radiation, but not from heavy blast damage. Protection from biological and chemical warfare agents are also discussed briefly. The blast and thermal effects of nuclear weapons on dwellings within the United States are tabulated and discussed. (C.H.)

11850

Weather Bureau, Washington, D. C.

[WORLD-WIDE FALL-OUT DISTRIBUTION AFTER NUCLEAR ATTACK]. TESTIMONY OF LESTER MACHTA. p.56-60 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation on the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

In computing world-wide fall-out following a nuclear attack, data must be obtained on how much radioactivity is available for dispersal and how it is dispersed. The production of radioactive debris is discussed with emphasis on strontium-90. Both local and world-wide fall-out deposition is calculated based on an idealized model. (C.H.)

11851

Naval Radiological Defense Lab., San Francisco.

BASIC PROPERTIES AND EFFECTS OF FALLOUT. COMPOSITION OF DEBRIS. Terry Triffet. p.61-111 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

The properties of the fall-out produced by a 5 megaton nuclear explosion (50% fission-50% fusion) are described. Land surface and water surface burst conditions are considered. The role of metals used in supporting towers and barges in fall-out formation is discussed. The over-all processes of fall-out formation and deposition are reviewed. Typical fall-out situations at near and distant stations are described and the arrival characteristics, the physical, chemical, and radiochemical properties, and the radiation characteristics of the contaminated material for the two conditions chosen are estimated. It is emphasized that widely different radiation doses could be received in regions not too far apart in a real fall-out area. The distinction is drawn between contaminated particles and the radiations from contaminated particles. This is used to emphasize the difference between external and internal radiation hazards from fall-out. (C.H.)

11852

Oak Ridge National Lab., Tenn.

EVALUATION OF RESIDENTIAL STRUCTURES FOR SHIELDING AGAINST FALL-OUT RADIATION. J. A. Auxier. p.148-51 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Results are reported from experiments for the evaluation of the shielding afforded by typical domestic houses against fall-out radiation. Experimental results are compared with theoretical studies. (C.H.)

11853

National Bureau of Standards, Washington, D. C.

SHIELDING FROM FALLOUT RADIATION. Charles M. Eisenhauer. p.151-63 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Results are reported from calculations and experiments to determine how radiation dose rates are modified inside buildings. In one experiment the roof, walls, and floors of a building were treated as barriers which reduce the intensity of gamma radiation. Calculations were also made for water and concrete barriers and lead, iron, and concrete. Data are included from experiments on the radiation shielding afforded by various types of structures. (C.H.)

11854

[FALL-OUT RADIOACTIVITY]. SUPPLEMENTAL MATERIAL. Ralph E. Lapp. p.210-28 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Data on the radioactivity of fission products are discussed. An estimate is presented of intercontinental fall-out resulting from a high level attack of 10,000 megatons upon the United States. The radiation dose in the U.S.S.R. during the first year is also estimated. The behavior of fall-out debris is examined from the standpoint of the external radiation hazard presented by local deposition of bomb-produced radioactivity. The effectiveness of residences as fall-out shelters is discussed and problems of home defense are considered. The status of the Federal program of civil defense is reviewed. The potentialities of enemy missile warheads and our strategic retaliation capabilities are discussed. It is concluded that the random sprawl of our cities coupled with the inherent inaccuracy of ballistic missiles makes it probable that large areas of our metropolitan sections will remain outside zones of heavy blast damage. The greatest hazard to the population will be from radioactivity in fall-out which will reach a peak about 50 to 75 miles downwind from the blast. The fundamental rule for survival in time of fall-out or suspected fall-out is below-ground shelter. This evasive action must take priority over all other activities. The average basement provides a ten-fold to twenty-fold reduction in the radiation dose. A tunnel in the cellar wall, stacked bags of coal, sand, or containers of water in a corner of the basement would also reduce the radiation dose. Data are tabulated on radiation doses at various times following a nuclear attack. Possible decontamination measures are considered. (C.H.)

11855

Naval Radiological Defense Lab., San Francisco.
SURVIVAL MEASURES. Walmer E. Strope. p.678-96 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Possibilities of defense against nuclear war are considered. Defense during the emergency phase and during the operational recovery phase of the attack are considered. Adequate shelter is considered the central countermeasure during the emergency phase of radiological defense. Design criteria for satisfactory shelters are presented. Within the basic specifications a number of alternatives are considered with respect to the degree of austerity in living accomodations and comfort in the shelter. Results indicate that adequate fall-out shelters may be provided for approximately $100 per person. Reclamation activities and costs are also discussed. (C.H.)

11856

California. Univ., Los Angeles.
[ENVIRONMENTAL CONTAMINATION BY FALL-OUT]. STATEMENT OF K. H. LARSON. p.796-831 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Fall-out phenomenology and characteristics are governed by many complex variables such as energy yield, wind structure, the support used for the detonation of devices, ground surface, degree of fireball intersect with ground surface, and mass of inert material or shielding surrounding the device. Data are summarized on the distribution, characteristics, and biological availability of fall-out originating from continental detonations. (C.H.)

11857

Weapons Systems Evaluation [Group]. Inst. for Defense Analyses, Washington, D. C.
THE DISTRIBUTION AND EFFECTS OF FALLOUT IN LARGE NUCLEAR-WEAPON CAMPAIGNS. Hugh Everett, III, and George E. Pugh. p.859-82 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Simple analytic formulas based on numerical data in Rand Memorandum RM-1969 are presented that enable a rapid statistical estimate of the distribution of fall-out and its effects on a population, as well as the consequences of changing the total delivered yield or the targeting doctrine. The method was checked against a detailed map study, using the same parameters, and was found to be in excellent agreement. A method of optimally distributing weapons among large areas in order to maximize radiation casualties is deduced on the basis of the formulas, and curves are exhibited expressing the casualties produced as a function of total yield delivered. The achievement of optimized attacks does not require a delivery accuracy with probable error less than about a hundred miles. In addition, the formulas are applied to a number of other targeting doctrines, and the resulting curves of casualties versus total delivered yield are presented. (C.H.)

11858

Princeton Univ., N. J.
[EFFECTS OF THERMONUCLEAR WAR]. STATEMENT OF HERMAN KAHN. p.882-922 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

Based on an objective study of the possible effects of thermonuclear war, it is concluded that while thermonuclear war would be an unprecedented catastrophe the limits on the magnitude of the catastrophe may be sharply dependent on what prewar measures have been taken. The study suggests that for the next 10 or 15 years, and perhaps for much longer, feasible combinations of military and nonmilitary defense measures can do much toward preserving a reasonable semblance of our prewar society. It was concluded that shelters with long occupancy time and the use of known anti-contamination techniques should make it possible to handle the acute radiation problem for the first three months following even severe attacks. In addition to protecting people from the immediate effects of the war, it is necessary to insure their survival in the postwar environment and to restore prewar standards of living if possible. This survival can best be accomplished if time-consuming preliminaries such as those involved in research, development, planning, analysis, design, programming, and legal questions have already been accomplished. A civil defense program is proposed and analyzed for cost. Combinations of military and nonmilitary measures which could provide valuable levels of protection in a nuclear war are discussed. The role of national policy and the attitude of the population is stressed. (C.H.)

11859

Atomic Energy Commission, Washington, D. C.
[EMERGENCY PROTECTION MEASURES IN NUCLEAR ATTACK]. STATEMENT OF DR. WILLARD F. LIBBY. p.923-41 of "Biological and Environmental Effects of Nuclear War. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session, June 22-26, 1959. Part I."

In the event of a nuclear war the number of casualties at the target may be relatively low in number but for hundreds of miles downwind the residual radiation will injure or kill those who are unprepared. Thus a densely populated area may find itself involved with results of events occurring hours earlier and many miles away. Our survival and recovery actions will depend upon an educated public who know about fall-out and the effects of nuclear radiation on people, animals, plants, food, and water. The policy of providing fall-out shelter is cited as an example of a practice which should be observed and copied. A design for a group shelter to protect 100 persons for two weeks or longer is presented. Various types of radio-radiation detectors, radiation detectors, and audible warning systems are described. Development is discussed of an inexpensive accessory for a transistor radio which will serve as a radiation warning device. (C.H.)

11860

THE DISTINCT BIOLOGICAL EFFECTS OF 30-MEV ELECTRONS, 31-MEV X RADIATION, AND 180-KEV X RADIATION. H. Fritz-Niggli (Radiotherapeutischen

Klinik des Kantonsspitals, Zurich). p.113-30 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

11861

THE EFFECT OF FAST ELECTRONS ON TISSUE CULTURES OF HeLa STOCK. H. Gärtner (Universität, Tübingen, Ger.). p.131-7 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

The first results obtained in irradiation studies on HeLa cultures are presented. The cultures were exposed to single fast electron doses of 250 and 500 r at a dose rate of 40 r/min. For comparison, studies were made with 250 and 500 r x radiation at the same dose rate. In the cytological evaluation the criteria used were mitosis frequency, mitosis phase distribution, interrupted mitosis, multinuclear and paranuclear mitosis, necrobiotic cell processes, and pyknosis, chromatolysis, and cytolysis. Irradiation greatly reduces the mitosis frequency. The calculated efficiency factor of both electron doses was 0.5. Fast electrons are only half as effective in checking mitosis as corresponding x-radiation doses. In HeLa cultures quantitative effective variations between fast electrons and x radiation appear significant, but qualitative variations are not detectable. A critical comparison was made of the radiation reaction on chicken heart fibroblasts and HeLa cells. The results showed that fast electrons, with respect to lethal damage, can produce a stronger effect in carcinoma cells of the HeLa stock than in chicken heart fibroblasts. (J.S.R.)

11862

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF ULTRA-HARD RADIATIONS AND THE INFERENCE ARISING FROM THIS FOR PRACTICAL RADIATION THERAPY. F. Wachsmann and G. Barth (Medizinische Universitätsklinik, Erlangen, Ger.). p.138-41 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

The variations in the RBE arising from the variability of the mean integral ionization density of "classical" and "ultra-hard" radiations are generally accepted today. The RBE values measured by various workers lie normally in the range from 0.4 to 1.2. It is, however, significant that the RBE varies not only with respect to object and reaction, but it is also dependent on the dose height and the instant of the observation. An increase of the "tumor electivity" in ultra-hard radiation is to be expected, but it is still unproved. First clinical observations have given conclusive information, however. (tr-auth)

11863

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF BETATRON RADIATION. W. Dittrich (Universitäts-Frauenklinik, Hamburg). p.142-5 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

The RBE of betatron radiation, with respect to hard x radiation as a standard in different radiation reactions, can assume distinct values. Precautions of practical radiation protection, with respect to possible genetic damage, necessitate RBE values of at least 1. External factors, especially oxygen pressure, make the biological effect of betatron radiation as distinct as the effect of hard x radiation. The variations resulting can excel a multiple by a change of the radiation type. (tr-auth)

11864

RADIOBIOLOGICAL INVESTIGATIONS ON THE EFFECTS OF FAST ELECTRONS. D. Hofmann (Justus-Liebig-Universität, Giessen, Ger.). p.146-50 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

It has been postulated that the effect of fast electrons is 0.4 to 0.7 times the effect of usual x radiation. The validity of this effect was tested on white mice by the use of 180-kev x radiation and fast electrons from $Sr-Y^{90}$. The result is shown in a dose effect curve which indicates that the dose quotient for a reference effect of 50% is 0.41. From a series of experiments on the indirect radiation effect in Drosophila using 60 kv and 180 kv x radiation and Sr^{90} radiation at 7900 r, significant curve variations were found. The qualitative effectiveness variations of the radiations were tested. (J.S.R.)

11865

DOSIMETRY OF ENERGETIC RADIATIONS. R. Glocker. p.151-5 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

The equations defining the exposure dose and absorbed dose in radiation dosimetry are given and discussed. In ultra-hard x radiation the difficulty arises that in the same chemical compounds the electron stopping ability has different values in liquid or solid states. The difficulties are removed when a radiation reaction in a solid or liquid material is used as the dosimetry standard instead of air ionization. Scintillators or chemical dosimetry can be used in this connection. The results obtainable are indicated. The basic equation for the evaluation of the radiation dose when scintillators or chemical dosimeters are used is given. (J.S.R.)

11866

CHEMICAL DOSIMETRY. S. Rösinger (Technische Hochschule, Stuttgart). p.156-9 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

The radiolytic decomposition of water, which affects the ferrous-ferric oxidation, was followed. The chemical effects of 15-Mev electrons and 200 kv x radiation were used. The G values obtained were compared with published results. The results indicated that both with decreasing ion densities and with increasing energy of the electron in the absorbing medium, the G value slightly increases. (J.S.R.)

11867

FILM MEASUREMENT OF THE DEPTH DISTRIBUTION OF THE DOSE FOR HIGH ENERGY ELECTRONS. J. M. Dutreix (Memorial Hospital, New York). p.160-8 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In French)

The utilization of photographic films for the measurement of the depth dose distribution of high-energy electrons was investigated. The standardization curves of the films were defined, and the precision attained in the measurement of the film density was discussed with respect to the development conditions and the measurement conditions. The response of the film depends neither on the electron energy nor on the scatterer placed at the tube window. The effect of the incidence angle was also studied. The utilization of the films in radiotherapy was discussed with a consideration of the dose distribution and the isodose curves. The isodose curves obtained in plexiglas by measurement of the optical density of the film are in good agreement with those obtained in water by ionization measurements. The darkening of the film by being placed directly in the Plexiglas phantom is considered. (J.S.R.)

11868

BACK-SCATTERING OF ELECTRONS IN VARIOUS MEDIA. G. Breitling (Universität, Tübingen, Ger.). p.169-72 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

The factors affecting the back-scattering of electrons in various media are discussed and tested on measurements of 6 to 15 Mev electrons. The experiments were made on plates of the materials which were placed perpendicular to the radiation path. The dependence of the back-scattering coefficient on the mass density was measured for lead, tin, copper, aluminum, and plexiglas. The dependence on the mass density was shown in copper for electrons of various energies. The pattern of the dose was also considered. Each of these was discussed with respect to the significance in radiotherapy. (J.S.R.)

11869

ABSOLUTE DOSIMETRY OF BETATRON ELECTRONS. B. Markus (Universitäts-Hautklinik, Göttingen, Ger.). p.173-81 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

The difficulties in the dosimetry of energetic radiation in conventional dose units are recapitulated. On the basis of a dose definition given, it was shown that, in the energy range of fast electrons, just as in that of ultra-hard x radiation, it is logical that the kinetic energy of the primary and secondary electrons (erg/cm^3) absorbed per volume element of the irradiated body be the basis of the dose conception, especially that of the "specific dose." Measurement possibilities of the specific electron dose were discussed. An apparatus is described which makes it possible to calibrate secondary standards (for example, thimble chambers) in absolute values of the electron number/cm^2 of chamber surface and the specific surface dose in erg/cm^3 of an irradiated body when electron moderating capability and the back-scattering factor of the materials are known. The absolute measurement of the electron current outside the acceleration apparatus is done by reception of the electron in a specially constructed Faraday box. An example was given of the absolute calibration. (tr-auth)

11870

INVESTIGATIONS OF THE DOSIMETRY AND SHIELDING OF 30-Mev ELECTRON BEAMS. M. Sempert and R. Wideröe (AG. Brown-Boveri u. Cie., Baden, Switzerland). p.182-91 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1–3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

The essential properties of the 30-Mev electron beam are briefly reviewed. The deep dose curves for 10, 20, and 30 Mev electrons, the variation of the deep dose curve with the field magnitude, and a comparison of the deep dose curve in water for various types of radiation are shown. In dose measurements made at the surface and within a phantom, it was shown that in the detector even thin chamber walls constructed of insulating material produced a considerable intensity decrease of the electron beam. The deep dose curves were obtained with Victoreen chambers and with films. The curves obtained with the films are somewhat better than those obtained with Victoreen chambers. The research arrangement is sketched. Typical deep dose curves obtained in the investigation are shown. The intensity equalization with and without scatterers of various thicknesses was measured. Grid therapy was also investigated and it is shown how the intensity of the sites covered with a brass plate increases by scattering when the electron enters deep in the phantom. (J.S.R.)

11871

RADIATION PROTECTION MEASUREMENTS ON FAST NEUTRONS. W. Pohlit (Max-Planck-Institut für Biophysik, Frankfurt am Main). p.192-5 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1-3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

In radiotherapy neutrons are formed by the nuclear photoeffect in screens, in the walls of the acceleration apparatus, and in the room walls hit by the gamma radiation. These neutrons react with the tissue atoms to produce fast charged particles. The energy transfer to the tissue elements is shown graphically. The neutron absorption in the tissue can be considered with respect to the hydrogen atom and therefore the tissue dose can be determined as a function of the dose in a hydrogenous material. A difficulty in this type of measurement is the gamma scattering radiation which is spatially and temporally inhomogeneous. Therefore an apparatus was constructed, which is composed of a gamma detector and a neutron detector, to overcome these difficulties in the measurement of the neutron dose. The gamma radiation is compensated so that dose measurements on neutrons show an increasing dosage with increasing energy of incident radiation. (J.S.R.)

11872

DOSE DISTRIBUTION IN ELECTRON GRID THERAPY. F. Gudden and A. Ehrly (Universität, Heidelberg, Ger.). p.196-8 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1-3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In German)

Investigations were made to determine the optimum grid conditions in electron grid therapy. The effects of the grid material, the aperture length, and the aperture diameter on the deep dose were determined. The relative deep dose in Plexiglas behind a lead screen of 7 mm thickness and an opening ratio of 55 : 45 was measured for electron energies of 15, 12.9, and 6 Mev. (J.S.R.)

11873

CALCULATION OF THE DEPTH DOSE IN MOVING THERAPY UNITS. V. Brazzoduro (Centro di Cure con Cobalto Radioattivo, Rome). p.199-204 of "Betatron and Telecobalt Therapy. International Symposium at the Czerny Hospital for Radiation Therapy of Heidelberg Univ., July 1-

3, 1957." J. Becker and K. E. Scheer, eds. Berlin, Springer-Verlag, 1958. 208p. (In French)

It is not possible to calculate with precision the depth dose received from rotating sources. A method for the approximate determination of the depth dose is given. It is based on a consideration of the dose administered to a certain tissue during a complete rotation of the source as if it came from a source which instead of traveling in a uniform motion traveled in a series of brief stops at a certain number of equidistant points. Experimental control of the method was done with a masonite phantom in the form of a cylinder. (J.S.R.)

ISOTOPE SEPARATION

11874 CEA-1185

France. Commissariat à l'Énergie Atomique, Paris.

LA CONTAGION ISOTOPIQUE DANS LES SÉPARATEURS ÉLECTROMAGNÉTIQUES D'ISOTOPES. (Isotopic Contamination in Electromagnetic Isotope Separators). Charles Cassignol. June 3, 1959. 58p.

Thesis submitted to Univ. of Paris.

The nuclides prepared by electromagnetic separation are known to be always contaminated by other isotopes. This isotopic contamination is strongly reduced by a second dispersive electrostatic stage, coupled in cascade with the electromagnetic separator of Saclay. The mechanisms of contamination are studied. There are two competing mechanisms: the scattering of the ion beams by the residual molecules or atoms and the instability of the ion sources the effects of which cannot be corrected simultaneously. By combining the two partial schemes one can account for all the facts relating to isotopic contamination. The data allow one to foresee the value of the enhancement factors which may be reached with magnetic or triple cascades. Such values turn out to be extremely high. (auth)

11875 CF-60-3-37

Oak Ridge National Lab., Tenn.

AN INVESTIGATION OF THERMAL DIFFUSION SEPARATION OF U-232–U-233 AS AN ALTERNATE TO REMOTE PROCESSING. S. H. Jury. Mar. 10, 1960. 7p. Contract [W-7405-eng-26]. OTS.

Liquid phase thermal diffusion separation of $U^{232}-U^{233}$ was investigated. The calculations were based on a horizontal type thermal diffusion column operating 24 hours/day on spent thorium fuel. The irradiation level is such that 8 tons contains ~80,000 g of U^{233} with about 500 ppm U^{232} in the U^{233} at the time of processing. For a column with a practical channel cross section and a temperature differential of 100°K across the barrier it was found that the enriching section at total reflux was 5.46×10^7 ft in length, and the strip section was 2.82×10^7 ft in length. Since these lengths must be even greater during product withdrawal, the use of thermal diffusion in this application was considered impractical due to excessive channel length, hold-up, and radiation shielding requirements. (auth)

11876 DEGIS-48(R)

United Kingdom Atomic Energy Authority. Development and Engineering Group, Risley, Lancs, England.

BIBLIOGRAPHY ON GAS SEPARATION BY CENTRIFUGE. J. R. Thomas and G. I. Maughan. Nov. 23, 1959. 9p. BIS.

Sixty-one unclassified references from U.K.A.E.A. Abstracts Index, Nuclear Science Abstracts, Chemical Abstracts (1937 to 57), and Science Abstracts "A" (1936 to 58) on centrifugal gas separation are presented. The emphasis is on applications in isotope separation. (J.R.D.)

11877 HW-63177

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PHOTOCHEMICAL SEPARATION OF MERCURY ISOTOPES. R. E. Ewing. Dec. 23, 1959. 19p. Contract AT(45-1)-1350. OTS.

A photochemical method for the separation of mercury isotopes was applied to the enrichment of Hg^{202} and Hg^{204}. The concentration of Hg^{204} increased from 6.8 to 11.7 mole % in a single passage through the apparatus. The separation appeared critically dependent upon the operating lamp. The construction and operation of the electrodeless mercury vapor lamp are discussed. (C.J.G.)

11878 AEC-tr-4029

STUDY ON THE SEPARATION OF ISOTOPES OF URANIUM. C. Fréjacques. Translated from Age nucleaire 1, 217-21(1959). 13p. JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 3717.

11879 JPRS-2393

A PHOTOCHEMICAL METHOD FOR SEPARATING MERCURY ISOTOPES. I. P. Shmelev. Translated from Priroda 44, No. 1, 84-5(1955). 4p. OTS.

A photochemical method for the separation of mercury isotopes is described. The reaction took place in a vessel in which was placed a discharge tube filled with vaporized Hg^{198}. Steam was passed into liquid mercury and the resulting vapor passed into the vessel. Emission from the discharge tube preferentially excited Hg^{198}, which reacted with the steam to form $Hg^{198}O$. The oxide of mercury was separated and allowed to form an amalgam on a copper wire. The mercury was evaporated and its vapor passed into a discharge tube for subsequent spectroscopic analysis of the isotopic composition. (C.J.G.)

11880

ISOTOPE ENRICHMENT BY ELECTROMIGRATION IN A MIXTURE OF MOLTEN $RbNO_3$ AND $LiNO_3$. Arnold Lundén (Chalmers Inst. of Tech., Göteborg). Ann. N. Y. Acad. Sci. 79, 988-96(1960) Jan. 30.

Applying Klemm's method for studying electromigration, the molten salt chain cathode-$LiNO_3$–$RbNO_3$-anode was electrolyzed for 107 hours at 450°C with a current density in the separation column of 3.5 amp/cm^2. The boundary between the two nitrates was not sharp; after the run both main compounds were present in all samples, together with various amounts of the impurities $NaNO_3$, KNO_3, and $CsNO_3$. The experiment was designed for studying the enrichment of Rb^{85} relative to Rb^{87}; the abundance ratio Rb^{85}/Rb^{87} was increased from 2.62 to 3.21. The elementary process separation factor, which is equal to the relative difference in mobility for the two ions, was 0.0011. The results is compared with isotope effects found in other mixtures and in pure salts. In addition, the isotope abundance ratios Li^7/Li^6 and K^{39}/K^{41} and the concentration ratios K/Rb, Cs/Rb, and Na/Li were measured, and their significance for mobility measurements are discussed. (auth)

11881

CHEMISTRY OF ISOTOPE FRACTIONATION. A. E. de Vries. Chem. Weekblad 55, 556-60(1959). (In Dutch)

A qualitative explanation is given for the presence of an isotope-effect in dissociations. The fractionating of isotopes in chemical processes is calculated by use of the dissociation of a compound AB into A and B. (Reactor Centrum Nederland).

11882

BIOLOGICAL FRACTIONATION OF ISOTOPES. H. J. M.

Bowen (Wantage Radiation Lab., Harwell, Berks, Eng.). Intern J. Appl. Radiation and Isotopes 7, 261-72(1960) Feb. (In English)

The fractionation of isotopes occurs in numerous biological processes, but the effects are always small except in a few cases involving hydrogen and deuterium. Fractionations may be caused by differences in rates of reaction or diffusion, or by differences in equilibrium constants. Very little systematic research has been published on this subject, but all the observed data agree with the hypothesis that light isotopes travel more quickly than heavy ones through metabolic pathways. There is a marked need for experiments in which the isotopic abundances in the growth medium, dissected organism and its excreta are recorded. Among the more interesting observations which have received special attention are the lethal effect of deuterium on most organisms, the use of C^{12}/C^{13} ratios in inferring the biogenic origin of carbon in ancient rocks, O^{18}/O^{16} ratios for determining the temperature of prehistoric seas and S^{32}/S^{34} ratios for deciding the date of evolution of sulfur bacteria. (auth)

11883

ISOTOPE SEPARATIONS USING ETHYLENEDIAMINETETRAACETIC ACID. G. Duyckaerts and R. Lejeune (Université, Liège). J. Chromatog. 3, 58-62(1960) Jan. (In French)

EDTA is an eluant with many possibilities for analytical chemistry. The results presented were obtained in the separation of carrier-free radioisotopes: separation of Ba—Sr—Y—La; preparation of Ra^{228} from thorium; separation of Ca—Sr—Ba—Ra. All the results were obtained with Dowex 50. (auth)

11884

SPACE-CHARGE COMPENSATED ION BEAM PREVENTS DIVERGENCE IN THE ION SEPARATION OF ISOTOPES. (to Siemens-Schuckertwerke Aktiengesellschaft). German Patent DAS 1 053 818. Mar. 26, 1959. Atompraxis 6, 70 (1960). (In German)

In apparatus which work with a fasciculated ion beam of high density, especially isotope separation apparatus or mass spectrographs, an undesirable divergence of the beam, which disturbs the deflections produced, occurs which is proportional to the repulsive power which the single ions exert on each other. In the invention this disadvantage is eliminated by total or partial space charge compensation with negative ions. In this manner, it is possible to obtain a beam which is neutral as a unit and therefore is neither inclined toward divergence nor influences the distribution of the separation field. In order to use the lowest number of negative ions, it is proposed to give a very low longitudinal velocity, that is, velocity in the direction of the beam axis, to the positive ions. The invention finds application where a beam of charged heavy particles should be made electrically neutral for the purpose of fasciculation or elimination of space charge effects.

MATHEMATICS AND COMPUTERS

11885 AERE-M-576

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

MERCURY AUTOCODE PROGRAM 255, FLUX INTEGRALS FROM THE HASSITT MULTIGROUP R, Z DIFFUSION THEORY PROGRAM. T. P. Moorhead. Dec. 1959. 12p. BIS.

A program for the Ferranti—Mercury computer is presented. The program takes the NU tape flux output of the Hassitt program and forms (approximately) the flux integrals $\Phi_i = \iint \phi_i \, RdRdZ$, where ϕ_i is the neutron flux in group i at radius R and axial position Z. The data tape specifies zone boundaries and regions may be sub-divided to exhibit spatial spectrum variation. Several cases can be done from one tape and subsequent tapes will be accepted. Average fluxes are also calculated over the same regions. (T.R.H.)

11886 AERE-R-3055

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

MERCURY AUTOCODE PROGRAM 228 MULTI-GROUP CROSS-SECTION PROCESSING. T. P. Moorhead. Dec. 1959. 28p. BIS.

A program for the Ferrant—Mercury is offered which will accept any set of cross sections for any given spectrum and composition and produce macroscopic constants required for calculations in any desired number of groups equal to or fewer than the input groups. Reduction in the number of groups is done by flux-weighting. The program is useful in all calculations where multi-energy-group nuclear cross sections are used. (T.R.H.)

11887 DEGR-40(R)

United Kingdom Atomic Energy Authority. Development and Engineering Group, Risley, Lancs, England.

A "MERCURY" WHIRLING SPEED PROGRAMME. J. A. Enderby. Nov. 11, 1959. 14p. BIS.

A program is presented for calculating the whirling speeds of rotating shafts running in symmetrical bearings of a very general kind. Deflection curves for given whirling speeds can also be obtained. (J.R.D.)

METALS, CERAMICS, AND MATERIALS

General and Miscellaneous

11888 A-2428-Z(WEC)

Westinghouse Electric Corp. Aviation Gas Turbine Div., Kansas City, Mo.

DEVELOPMENT OF NIOBIUM BASE ALLOYS. Quarterly Progress Report No. 6 Covering Period June 15, 1957. 15p. September 15, 1957. R. T. Begley. Sept. 15, 1957. 15p. Contract AF33(616)-3316.

Major emphasis during the period was on the assembly of a levitation melting unit which is described in detail. Other phases of the contract activity such as investigations of pure Nb, arc melting, and welding were studied. (For preceding period see A-2388(WEC).) (J.R.D.)

11889 AEEW-R-7

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Winfrith, Dorset, England.

THERMAL STRESSES IN LONG PRISMS BY RELAXATION METHODS. J. D. Cummins. July 1959. 41p. BIS.

A method is presented for calculating the elastic thermal stresses in the class of material shapes known as long prisms which are producing heat. The problem of an inverted lattice (hexagonal coolant passage surrounded by hexagonal fuel elements) is considered and the temperature and principal thermal stress distributions evaluated for the particular case of 20% coolant in a cermet fueled reactor. The maximum thermal stress for this type of fuel element was found to be about the same as the maximum thermal stress in a cylindrical fuel element surrounded by a sea of coolant, assuming the existence of the same maximum temperature drop and material properties. (auth)

11890 AFOSR-TN-60-207
Rensselaer Polytechnic Inst., Troy, N. Y.
STATISTICAL BIFURCATION OF FRICTION. Technical Note No. 5 [on] WELDING ASPECT OF SLIDING FRICTION BETWEEN METALLIC SURFACES. F. F. Ling and R. S. Weiner. Jan. 10, 1960. 27p. Project No. 19751. Contract AF49(638)-67.

An apparatus used for measuring adhesion, pure-shear, and friction at so-called extreme pressures is described. Areas of contact are measured qualitatively by means of electric contact resistances and quantitatively by scanning the specimen with a microscope. Test results show a statistical bifurcation of frictional resistance for lead on lead, that is, below extreme pressures there are two branches of the coefficient of friction vs. normal load relationship. The nature of the upper branch of the coefficient of friction vs. normal load relationship is explicable in terms of the weld-junction theory exclusively. The lower branch, however, has yet to be satisfactorily explained. (auth)

11891 ATL-A-104
Advanced Technology Labs. Div. of American-Standard, Mountain View, Calif.
DEVELOPMENT OF METALLIC URANIUM FUEL ELEMENTS OF IMPROVED IRRADIATION STABILITY. Semiannual Progress Report No. 1. Dec. 14, 1959. 45p. Contract AT(04-3)-250, Project Agreement No. 2. OTS.

The feasibility of improving swelling resistance in metallic uranium by increasing the dislocation density is under investigation. Increasing the density of dislocations is expected to increase the number of sites at which fission product gas atoms are "pinned," increase the number of gas bubble nuclei, and increase mechanical strength. Dislocations are introduced by a treatment which involves deformation of metastable beta or gamma phase in uranium-rich alloys, followed by transformation. Activity has been concerned primarily with selection of uranium-base alloys for initial evaluation, procurement of materials, installation of specialized equipment, and development of techniques. A number of small ingots were produced, and screening tests were carried out on several analyses. These preliminary experiments were designed to show the deformation characteristics of the alloys in the metastable state as a function of rolling temperature and time. Initial results on gamma-stabilized binary alloys containing 2, 3.5, 5, and 7 wt. % Mo showed that large reductions are possible in 5 and 7 wt. % Mo alloys at 450°C. The more dilute alloys are relatively difficult to roll, although small reductions were achieved. Aging experiments on deformed and undeformed 5 wt. % Mo alloys indicate that deformation accelerates the aging process and retards growth of the "pearlitic" eutectoid transformation product. Results with dilute chromium and chromium—molybdenum alloys showed that rolling is possible in the metastable beta phase for a short time at temperatures as low as 450°C. The beta phase is quite hard at lower temperatures, however, and cracking occurs in some alloys at relatively small reductions. Beta phase deformation of these alloys resulted in no significant hardness increase, although final grain size was reduced appreciably. Additional experimental work is required to complete the screening of uranium alloys for application to the current program. Following this activity, several of the most promising alloys will be selected for an intensive investigation of the effect of processing variables on mechanical properties, microstructure, and structural stability. Irradiation testing and post-irradiation evaluation of treated alloys will be undertaken later as Phase II of the over-all program. (auth)

11892 CEA-1191
France. Commissariat à l'Énergie Atomique, Paris.
INFLUENCE DU CARBONE SUR L'OXYGENATION DU ZIRCONIUM A HAUTE TEMPERATURE. (Effect of Carbon on the Oxidation of Zirconium at High Temperature). G. Chauvin, B. Boudouresques, H. Coriou, and J. Hure. 1957. 26p.

The study of specimens contamined by different amounts of carbon shows a deleterious effect of this element in the resistance of zirconium to high temperature oxidation (700 to 900°C). The following results were obtained: The white spots or pimples observed by numerous authors seem to be caused by the oxidation of precipitated carbides. A mechanism of formation and growth of these pimples is suggested. For a certain carbon content, the resistance to oxidation is increased by uniform dispersion of the carbide phase and decreased, for instance, by extrusion textures. In this case, for the more marked textures, the more oriented corrosion was observed. By burning the carbide phase a second reaction can result increasing the corrosion rate. Thin zirconium foils undergo dimensional changes when scaling in oxygen. This unusual feature is also subordinated to carbon content and especially to the carbide phase dispersion. (auth)

11893 CEA-1253
France. Commissariat à l'Énergie Atomique, Paris.
REALISATION D'UNE INSTALLATION D'ANALYSE THERMIQUE DIFFERENTIELLE. (Construction of a Differential Thermal Analysis Installation). G. Branche and F. Chantret. 1959. 19p.

The characteristics of a D.T.A. installation are described. Experimental rooms, ovens, thermal regulation, and recording methods are thoroughly described, with outlining of the requirements to obtain a high sensitivity. Numerous D.T.A. curves relating to argillaceous substances, bituminous shales, and uraniferous compounds are given. (auth)

11894 CF-60-3-81
Oak Ridge National Lab., Tenn.
SOME REMARKS ON THE CONTRIBUTION OF FISSION-PRODUCT CESIUM TO THE PRESSURE BUILDUP IN UO_2 FUEL ELEMENTS. M. W. Rosenthal and S. Cantor. Mar. 18, 1960. 9p. OTS.

The large fission yield of cesium and its apparent mobility in hot UO_2 cause concern that it may contribute importantly to the pressure buildup inside clad fuel elements. A study indicated that the pressure will be essentially that of metallic cesium, and no significant addition will result from the formation of chemical compounds. The vapor pressure in a fuel element will be that associated with the coldest point accessible to the vapor; since there will be temperatures below 1200°F near the ends of EGCR fuel elements, the cesium vapor pressure will be less than 1 atm (Cs B.P. = 1274°F). If cesium is still of concern, it can probably be trapped and its vapor pressure greatly reduced by the use of a getter, such as tin or bismuth. (auth)

11895 DMIC-Memo-42
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
STANDARD DESIGNATIONS OF ALLOYS FOR AIRCRAFT

AND MISSILES. TRADE NAMES, AERONAUTICAL AND MILITARY SPECIFICATIONS AND PRODUCERS OF STAINLESS STEELS, ALLOY STEELS, AND SUPERALLOYS. J. J. Vagi, comp. Jan. 25, 1960. 60p. (PB-161191). OTS.

Tabulations are presented which were prepared to assist in classifying information on metals and alloys for aircraft and missiles. The tabulations include trade designations, aeronautical material specifications, hot-work tool steels, and a listing of selected high-strength and heat- and corrosion-resistant alloys. (J.R.D.)

11896 DMIC-Memo-44
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
REFRACTORY MATERIALS. R. I. Jaffee and D. J. Maykuth. Feb. 26, 1960. 34p. (PB-161194). OTS.

Presented at the 28th Annual Meeting of the Institute of Aeronautical Sciences in New York on January 25, 1960.

The availability, extraction, consolidation, fabrication, stability, mechanical behavior at low and high temperatures, and physical properties important in thermal stress are discussed for a number of refractory materials. (W.L.H.)

11897 HW-62942
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ZIRCALOY-2 PILOT PLANT ETCHING AND RINSING FACILITY. H. P. Maffei. Dec. 15, 1959. 17p. Contract AT(45-1)-1350. OTS.

A description of the HAPO facility for processing Zircaloy-2 clad fuel elements and components is presented. Included are discussions of the Zircaloy-2 etching and rinsing process, plant operating procedures and hazards, and current experiments and data relevant to etching and rinsing. (J.R.D.)

11898 KAPL-1305
Knolls Atomic Power Lab., Schenectady, N. Y.
METALLURGY REPORT OF THE TECHNICAL DEPARTMENT [FOR] DECEMBER 1954, JANUARY, FEBRUARY 1955. Decl. Mar. 2, 1960. 50p. Contract W-31-109-Eng-52. OTS.

The low-temperature diffusion of U—Al couples showed erratic results, which are believed to be caused by the oxide film. A technique was found for preparing Zr—Mg diffusion couples. Experimental determination of the limits of the two-phase liquid region of the Na—Si phase diagram was completed. The causes of brittle failure in Mn—Ni braze wire were elucidated. Decomposition of the epsilon phase in U—Zr alloys to alpha U and alpha Zr was found at temperatures above 500°C and may occur at even lower temperatures. A special alloy of U containing small amounts of fission product metals was made. After a large exposure, a single U crystal shows no evidence of rotation of lattice. A new mechanism was proposed to explain Kr diffusion from irradiated U. Irradiation effects on LiF are under continued examination. New data on the electrical conductivity of Ti as affected by radiation were obtained. The effect of radiation on the mechanical properties of Fe was studied extensively. Fuel slugs, coated with Zr, were jacketed with Al by hot-press canning. (For preceding period see KAPL-1256). (C.W.H.)

11899 KLX-10119
Vitro Labs., West Orange, N. J.
ELECTROPHORETIC PROCESSES—NUCLEAR ASPECTS. Final Report [for] December 1, 1956—June 30, 1959. Vitro Job 2091. R. A. Keeler and S. J. Klach. Sept. 30, 1959. 48p. Contract AT(30-1)-1996. OTS.

The feasibility of the electrophoretic (electrokinetic) coating process has been demonstrated for a number of nuclear applications. The major portion of the experimental program was directed toward work which leads to: development of electrophoretic coatings which should be useful for the protection of graphite and graphite fuel elements against physical and chemical attack under reactor conditions. Several of these coatings also show promise for fission product retention; a technique for applying, electrophoretically, solid lubricant-metal matrix coatings for use at elevated temperatures and in high nuclear flux environments; and an electrophoretic method for applying impervious aluminum oxide coatings on ceramic fuel elements for fission product retention. Other experimental work, (special evaluation studies) of a more limited nature, was directed toward establishing the utility of the electrophoretic process for: applying on UO_2 platelets chromium coatings to act as a diffusion barrier between the platelet and the canning material; depositing cadmium coatings on mild steel for use as control rods; applying coatings on graphite which would act as barriers against diffusion of fission products under special LMFRE tests; and applying thick (15-20 mil), dense molybdenum coatings on stainless steel. (auth)

11900 NDA-2145-1
Carborundum Co., Niagara Falls, N. Y.
CARBIDE FUEL DEVELOPMENT. Progress Report [for] Period of September 15, 1959 to January 31, 1960. A. Strasser and K. Taylor. Mar. 11, 1960. 22p. Project IV. For Nuclear Development Corp. of America. Contract AT(30-1)-2303. OTS.

A 6 lb batch of good quality UC was synthesized by the UO_2—carbon reaction. Pellets with densities up to 13.0 g/cc, or 95% of theoretical, were produced by cold pressing and sintering. Hot pressing of UC powder in an aluminum nitride die, rather than graphite die, reduced the reaction with the die material by a considerable factor. Promising results were obtained by limited efforts on the synthesis of UC by the ammonium diuranate—carbon reaction, and the simultaneous reacting and hot pressing of U metal and carbon. Specimens for compatibility tests between UC and prospective cladding materials (Type 304 SS, 2½% Cr—1% Mo, Inconel X, niobium, beryllium, and Zircaloy-2) were assembled and are being tested at 820°C. The design of irradiation capsules was completed. Dissolution studies of unirradiated UC with simulated fission products showed that 99.97% U recovery is possible. (For preceding period see NDA-2140-2.) (W.L.H.)

11901 NMI-1231
Nuclear Metals, Inc., Concord, Mass.
SOLUTION TECHNIQUE IN ANALYSIS OF METAL ALLOYS BY X-RAY FLUORESCENT SPECTROMETRY. F. A. Bauman, B. Wessling, and L. Zopatti. Mar. 30, 1960. 22p. Contract AT(30-1)-1565. OTS.

In a study of the effect of variations in the amounts of diverse metal and acid ions present in a solution of metal alloy to be analyzed by x-ray fluorescence, there was no appreciable metal-metal interference, other than direct line interference, in any practical case. There was, however, signal attenuation by all common solvent acids; absolute acid concentration must therefore be controlled to tenths of a milliliter for any quantitative work. (auth)

11902 NP-8445
Westinghouse Electric Corp. Research Labs., Pittsburgh.
DEVELOPMENT OF A NICKEL-BASE MATERIAL DISPERSION-HARDENED BY ALUMINA FOR 1600°F TO 2000°F SERVICE. Progress Report No. 4 [for] July 7,

1959 through September 6, 1959. D. H. Feisel. Oct. 15, 1959. 8p. Contract NOas-59-6051-C.

Five experimental alloys were fabricated into rods by extrusion at 2400°F. Each of the alloys contains a dispersion of very finely divided alumina particles in nominal amounts of about 10% by volume in a nickel-base matrix. Four of the matrix compositions are such that they will possess an ordered structure related to the face-centered cubic lattice, while the fifth alloy is essentially nickel. The Vickers hardness numbers of the best alloys, close to 400 DPH, indicate that the aluminum oxide particles have been well dispersed resulting in a hardening of the matrix. The extruded rods will provide material for aging, creep-rupture, tensile, oxidation, workability, and microstructural studies. Additional alloys of other compositions are being prepared. (auth)

11903 NP-8446
Westinghouse Electric Corp. Research Labs., Pittsburgh.
DEVELOPMENT OF A NICKEL-BASE MATERIAL DISPERSION-HARDENED BY ALUMINA FOR 1600°F TO 2000°F SERVICE. Progress Report No. 5 [for] September 7, 1959 through November 6, 1959. D. H. Feisel. Dec. 11, 1959. 15p. Contract NOas-59-6051-C.

Test specimens were machined from extrusions of five experimental alloys containing dispersions of aluminum oxide particles. Data are presented for tensile properties at room and elevated temperatures, stress-rupture at elevated temperatures, and the effects of exposure to air at 1800°F. The chemical compositions and microstructures are also discussed. Further examination of properties of these alloys is underway. Additional alloys are also being prepared. (For preceding period see NP-8445.) (auth)

11904 NP-8465
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
DEFENSE METALS INFORMATION CENTER SELECTED ACCESSIONS, FEBRUARY 1 and 15, 1960. M. J. Wahll, comp. 112p.

A list of selected DMIC accessions from Feb. 1 to 15, 1960, is presented. The information is grouped under the subjects light metals, refractory metals, high-strength alloys, miscellaneous metals, and special subjects. Resumés are included in most cases. (J.R.D.)

11905 NP-8500
Virginia. Univ., Charlottesville. Research Labs. for Engineering Sciences.
THE APPLICATION OF HIGH ROTATIONAL SPEED TECHNIQUES TO THE STUDY OF ADHESION OF ELECTRODEPOSITS. Quarterly Progress Report No. 1 for the Period November 20, 1959 to February 20, 1960. William H. Dancy, Jr. Mar. 1960. 13p. Project No. DA-502-02-017. Contract DA-36-034-504-ORD-3125RD. (EP-2933-101-60U).

Chromium-plated test rotors were prepared using various steel alloys. Methods of preparation and testing are described in which the adhesion of chromium on various steels was investigated at high current density and at high temperature. Data on chromium deposition are included. (J.R.D.)

11906 NP-8505
Office of Technical Services, Washington, D. C.
CLASSIFICATION OF SOVIET GAS-TURBINE STEELS. REVIEW OF SOVIET LITERATURE, 1954-1959. Oct. 29, 1959. 18p. OTS.

Characteristics of Soviet high-temperature steels, especially those used in manufacture of gas turbines, are described. A code for use in classification of these steels is included. The information was obtained in a review of Soviet literature from 1954 to 1959. (J.R.D.)

11907 NP-8523
Battelle Memorial Inst., Columbus, Ohio.
DEFENSE METALS INFORMATION CENTER SELECTED ACCESSIONS. Mar. 1960. 99p.

A listing of selected acquired articles, reports, and papers is presented concerning light metals, high-strength alloys, miscellaneous metals, and special subjects such as applications, coatings, fabrication, non-metallic refractories, properties, and thermal protection. (W.L.H.)

11908 ORO-219
Clevite Corp. Mechanical Research Div., Cleveland.
MONTHLY PROGRESS LETTER NO. 5 [FOR] PERIOD OCTOBER 1, 1959 TO OCTOBER 31, 1959. R. Baskey. Nov. 10, 1959. 3p. Contract AT(40-1)-2557. OTS.

Progress in hot and cold pressing fuels for attainment of maximum density is outlined. Data on vacuum injection castings are also included. Chemical analysis of these castings indicated a glass content of 20% by weight. Measurements were made to determine the reduction in area on tensile specimens. The reduction increased with temperature. Samples of glass containing 2, 10, 30, and 50% U_3O_8 were prepared and analyzed. Chemical and x-ray fluorescence analysis data were used to prepare a calibration plot for use in future analyses. (J.R.D.)

11909 ORO-262
Union Carbide Metals Co., Niagara Falls, N. Y.
COLUMBIUM CLAD URANIUM CARBIDE FUEL ELEMENT. Quarterly Report No. 3 [for] November 1, 1959–January 31, 1960. J. J. Finley, M. Korchynsky, and S. Sarian. Feb. 26, 1960. 30p. Contract AT(40-1)-2559. OTS.

Progress made in the areas of preparation and consolidation of uranium monocarbide (UC) is summarized. Conditions for optimization of the formation of UC by the uranium metal–methane reaction are discussed. Consolidation of UC by powder metallurgical techniques results in densities of 12.7 g/cm^3 by cold-pressing and sintering at 1900°C in argon, and of 13.3 g/cm^3 by vacuum hot-pressing at 1500°C. These data compare well with the theoretical density of 13.6 g/cm^3. Initial experiments in slip casting of UC are described. Compatibility studies of UC and columbium-base alloys, selected as eventual cladding material, fail to reveal an interaction after 100 hours at 1100°C in argon. (For preceding period see ORO-222.) (auth)

11910 TID-8203
Battelle Memorial Inst., Columbus, Ohio.
POTENTIAL NONNUCLEAR USES FOR DEPLETED URANIUM. Harlan W. Nelson and Ronald L. Carmichael. Jan. 29, 1960. 61p. Contract W-7405-eng-92. OTS.

A review is presented of the physical and chemical properties of depleted U and its principal compounds and a brief account is given of the mechanical properties. Also included are sections devoted to the past industrial uses for U and its products and to the health and safety aspects of handling depleted U in an industrial shop. Potential uses in the fields of semiconductors, cathodic protection, ion exchange, heavy-density media for mineral concentration, and some metallurgical applications are considered. Sections involving metallurgical applications, radiation shielding, and ceramic uses are presented in detail. (W.L.H.)

11911 IGIS-90(RD/C)
CHEMICAL ANALYSIS IN THE QUALITY CONTROL OF REACTOR GRAPHITE. P. M. Strocchi, S. Noe, and

P. Rebora. Translated by T. Rigg (U.K.A.E.A., Culcheth) from Energia nucleare (Milan) 5, 815-23(1958). 16p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 7523.

11912 TT-866

ELECTRON DIFFRACTION INVESTIGATION OF THE SYSTEM CADMIUM–TELLURIUM. (Elektronograficheskoe Issledovanie Sistemy Splavov Kadmii–Tellur). S. A. Semiletov. Translated by G. Belkov (National Research Council of Canada) from Trudy Inst. Krist. Akad. Nauk S.S.S.R. 11, 121-3(1955). 7p. JCL.

An electron diffraction investigation of the Cd–Te system is described. Samples for investigation were prepared in the form of layer 10^{-5} to 10^{-6} cm thick by condensing vapors in a vacuum with simultaneous evaporation of the component of the compound CdTe or an alloy with an arbitrary content of the components. As substrates for the condensation use was made of cleavage faces of crystals of rock salt or mica, celluloid films, and glass plates. Electron diffraction patterns were obtained from Cd + CdTe, CdTe, and CdTe + Te. (W.L.H.)

11913

OPERATIONAL PERFORMANCE OF BONDED AND UNBONDED URANIUM FUEL RODS. T. T. Claudson, G. T. Geering, J. W. Goffard, and J. E. Minor (General Electric Co., Richland, Wash.). Am. Inst. Mining Met., Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. No. 9, 25-34 (1959).

The irradiation performances of unbonded uranium rods clad in stainless steel and uranium rods clad in and bonded to Zircaloy-2 are discussed. In the clad unbonded specimen, irradiation over a range of burnups from 0.1 to 0.41 at. % revealed that dimensional changes in the uranium are not linearly dependent upon exposure or temperature. Macrocracking of the core at 0.28 at. % was observed in bonded rods. Mechanisms of this cracking effect are discussed. Evidence of recrystallization in the upper α-phase region was found in rods bonded to Zircaloy-2 cladding.

11914

RELEASE OF FISSION PRODUCTS FROM FUELED GRAPHITE. W. C. Riley, D. N. Sunderman, and B. W. Dunnington (Battelle Memorial Inst., Columbus, Ohio). Am. Inst. Mining Met., Petrol. Engrs., Inst. Metals Spec. Rept. Ser. No. 9, 87-94(1959).

Irradiation experiments were performed on fueled graphite to study fission-product release at high temperatures. Very large fission-gas release was observed in elements irradiated or annealed at temperatures in the range of 1000 to 1700°F. Modifications to the fueled graphite, such as increasing the fuel particle size and the use of either external coatings or coatings on fuel particles, were found to result in large reductions in fission-product release. The effect on release rate of fuel-element temperature, time at temperature, irradiation rate, and level is given for various types of fueled graphite. (auth)

11915

USE OF RADIOACTIVE ISOTOPES OF ARSENIC AND NIOBIUM FOR INVESTIGATIONS ON METALLURGICAL REACTIONS. M. L. Sazonov and L. A. Schwarzman (Inst. of Metal Physics, Moscow and Central Ferrous Metallurgy Inst., Moscow). Intern. J. Appl. Radiation and Isotopes 7, 311-16(1960) Feb. (In English)

Methods for investigation of arsenic and niobium distribution between iron and slag by means of radioactive isotopes of these elements (As^{76} and Nb^{95}) are studied. Special emphasis is placed on the technique used for the removal of radioactive admixtures and for the identification of radioactive isotopes. Thermodynamic data characteristic of the oxidation of arsenic and niobium dissolved in liquid iron are given. (auth)

11916

NEODYMIUM MIXED METAL HYDRIDE. K. Dialer and B. Frank (Technische Hochschule, Hanover). Z. Naturforsch. 15b, 57-8(1960) Jan. (In German)

Neodymium mixed metal (80% Nd, 19% Pr, and the rest Fe and Ca) can be charged, under normal conditions, with pure hydrogen up to the trihydride. The stoichiometric trihydride can be obtained with hydrogen pressures of 1 atm only at relatively low temperatures. To obtain a survey of the phase ratios, the formation enthalpies of products with varying hydrogen contents were determined calorimetrically. The results are graphed. (J.S.R.)

11917

Division of Reactor Development, AEC.

THE METALLURGY OF HAFNIUM. D. E. Thomas and Earl T. Hayes, eds. [1960]. 395p. $1.50(GPO).

The properties and applications of hafnium are discussed. Hafnium extraction, reduction, refining, and fabrication processes are reviewed. The properties of various hafnium alloys and systems are discussed. Methods of analysis for hafnium are reviewed. (C.J.G.)

11918

IMPROVEMENTS RELATING TO THE REFINING OF HEAVY METALS BY ZONE MELTING. Thomas Edward Allibone (Associated Electrical Industries, Ltd.). British Patent 831,305. Mar. 30, 1960.

A zone-refining apparatus and procedure are described for reactor fuel elements. An induction-heated molten zone is moved along an irradiated fuel rod so that the cladding is not affected but the U, Pu, or Th core is refined by exchange of fission products into the liquid phase. The use of an absorbent metal such as Mg, Ag, Ce, or La in the molten zone to absorb impurities but not alloy the fuel metal is also suggested. (T.R.H.)

11919

IMPROVEMENTS IN OR RELATING TO NUCLEAR FUEL MATERIALS. William James Keith Wright and Jack Williams (to United Kingdom Atomic Energy Authority). British Patent 831,427. Mar. 30, 1960.

A cermet nuclear fuel material is described. In an example, 50 parts of sponge Fe and 40 parts of powdered Al_2O_3 and 10 parts UO_2 were mixed, sealed in a steel cylinder, and fired at 1200°C before extrusion. The press was limited to 700 tons and the speed was 6 to 8 in./sec with a cross-section reduction factor of 14. A core density of 98% theoretical was obtained with a good bond between steel and core. (T.R.H.)

11920

IMPROVEMENTS IN OR RELATING TO PRODUCTION OF METALS BY ELECTROLYSIS. Allan Robert Gibson (to United Kingdom Atomic Energy Authority). British Patent 832,190. Apr. 6, 1960.

In the production of metals by fused-salt electrolysis, the efficiency is reduced by oxidation at the anode and movement of the oxidation products toward the cathode. The use of H_2 at the anode to act as reducing agent and increase efficiency is described. In an example, to a KCl–NaCl eutectic at 800 to 850°C 15 wt.% UCl_3 was added. A graphite-tube anode connected to a H_2 supply and a U cathode were used for electrolysis at 3 to 3.3 v and 45 to 50 amp. The cathode efficiency was 87%. (T.R.H.)

Corrosion

11921 AD-229559

Massachusetts Inst. of Tech., Cambridge. Corrosion Lab. CORROSION BEHAVIOR AND PASSIVITY OF NICKEL—CHROMIUM AND COBALT—CHROMIUM ALLOYS. A. Paul Bond and H. H. Uhlig. [1959]. 26p.

Pure Ni—Cr alloys containing up to 29% Cr and Co—Cr alloys containing up to 23% Cr were prepared in vacuum. Corrosion rates in sulfuric and nitric acids, corrosion potentials, and critical current densities for passivity were determined at 25°C. It is concluded that specific alloying proportions of passive compositions are better evaluated in relation to electron configuration of the alloy system by critical current densities than by potential or corrosion rate measurements. (auth)

11922 ANL-5090

Argonne National Lab., Lemont, Ill. CORROSION OF PLUTONIUM ALLOYS IN NaK. H. H. Hyman and J. J. Katz. July 1953. Decl. Mar. 15, 1960. 10p. Contract W-31-109-eng-38. OTS.

A Pu-Al alloy containing 4 at. % Al showed no attack after exposure to purified NaK for one month at 400°C in the absence of any oxide. The same specimen and other Pu alloys, including pure Pu, showed marked deterioration in shorter exposures in the presence of oxide films from a welded stainless steel container. Pure U was found to be resistant in the presence of such oxides. (auth)

11923 ARF-2152-10

Illinois Inst. of Tech., Chicago. Armour Research Foundation. ON A SURFACE ENERGY MECHANISM FOR STRESS-CORROSION CRACKING. A MECHANISM FOR STRESS-CORROSION EMBRITTLEMENT. E. G. Coleman, D. Weinstein, and W. Rostoker. Feb. 1960. 20p. Contract Nonr-2602(00).

It has been demonstrated that stress-corrosion cracks can be initiated on continuous loading in a suitable medium. Results are shown for stainless steel immersed in boiling $MgCl_2$ solution and for a Mg—6% Al alloy in aqueous NaCl—K_2CrO_4 solution at room temperature. This behavior has been used to analyze the stress-corrosion cracking process in terms of the dislocation theory of brittle fracture. It is proposed that the mechanism of cracking originates from a condition of reduced surface energy brought about by adsorption of some ion species from the surrounding medium. An analysis of the grain size dependence of the fracture initiation stress in the stress-corrosion media leads to estimates of reduced surface energies of the order of 100 to 200 ergs/cm^2. (auth)

11924 CEA-1192

France. Commissariat à l'Énergie Atomique, Paris. INFLUENCE DU SILICIUM SUR LA RESISTANCE D'ALLIAGES ALUMINIUM—FER A LA CORROSION PAR L'EAU A HAUTE TEMPERATURE. (Influence of Silicon on the Resistance of Al—Fe Alloys to Corrosion by Water at High Temperature). H. Coriou, L. Grall, A. Hauptman, and J. Hure. 1959. 14p.

A range of alloys with addition contents of 0.3 to 0.6 per cent of iron and 0.06 to 0.4 per cent of Si were corrosion tested between 250 and 300°C, in demineralized water. Micrographic results were connected with thermal treatments and compositions. The effect of Si is deleterious, particularly in solid solution, and iron offsets this action precipitating it in ternary compounds Al-Fe-Si. This produces as a consequence a consumption of iron. Iron is essential in quantities necessary to precipitate Al_3Fe which is neccessary to have good resistance to corrosion. (auth)

11925 CEA-1313

France. Commissariat à l'Énergie Atomique, Paris. LES ALLIAGES ALUMINIUM—FER—NICKEL RESISTANT A LA CORROSION PAR L'EAU A HAUTE TEMPERATURE. BASES DE LEURS PROPRIETES—LEUR AMELIORATION. (Aluminium—Nickel—Iron Alloys Resistant to Corrosion by Water at High Temperature. Basis for Their Properties—Their Improvement). H. Coriou, R. Fournier, L. Grall, and J. Hure. 1959. 32p.

Presented at the AEC-Euratom Conference on Aqueous Corrosion of Reactor Materials, Brussels, Belgium, October 14—17, 1959.

The development of the investigations carried out on these alloys is reviewed, showing the establishment of their fundamental, particularly structural, properties. The penetration process in corrosion was studied. The results of micrographic studies of the metal oxide interface are given for a series of alloys treated in water and steam between 350 and 395°C. The hypothesis of attack by pockets of gas pressure is corroborated, and a second process of deep penetration by islands of intergranular-type corrosion is shown to take place. These patches, distinct from the surface corrosion layer and sometimes forming at a considerable depth inside the metal, would be due to heterogeneities in composition of the solid solution making up the matrix of these alloys. The role of titanium and zirconium additions on rolled metal was also studied. Systematic studies were carried out on a series of alloys with titanium and zirconium contents between 0.05 and 0.15 per cent. The favorable effect of titanium in particular was demonstrated. Zirconium acts in the same way, but less efficiently. The improvement due to these additions can be compared to their action on the distribution of the second phases, which tend to become more pronounced and more homogeneously distributed. The influence of welding on these alloys has been studied, showing up the part played by the structure gradients introduced by fusion. (auth)

11926 DMIC-123

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio. OXIDATION BEHAVIOR AND PROTECTIVE COATINGS FOR COLUMBIUM AND COLUMBIUM-BASE ALLOYS. W. D. Klopp. Jan. 15, 1960. 99p. Contract AF18(600)-1375. (PB-151080). OTS.

Available information on the oxidation behavior of and protective coatings for Nb and Nb-base alloys is summarized and discussed. Unalloyed Nb forms a tarnish film and reacts parabolically with air or oxygen up to about 450°C. In this temperature range the protective film blisters and unprotective, white Nb_2O_5 forms. Oxidation behavior is linear after formation of Nb_2O_5, the rate increasing appreciably with increasing temperature. Nb_2O_5 is solid to 1500°C. Binary additions which improve the oxidation resistance include Ti, Zr, Mo, W, Cr, and V. Ti and Zr also improve the contamination resistance of Nb. Ternary and higher alloying produces further significant improvements in oxidation behavior by promoting formation of complex oxide scales. Several of the best systems are Nb—Cr—Al, Nb—Fe—Al, Nb—Mo—Al, Nb—Ti—Al, and Nb—Ti—Cr. Improvements up to 1000-fold over unalloyed Nb are possible, but the most oxidation-resistant alloys are unfabricable. Information on protective coatings for Nb is limited. The best coatings to date appear to be a duplex LM-5 coating and a modified Ni—C coating. (auth)

11927 IDO-14479
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
CORROSION OF TITANIUM IN THE SYSTEM: $HNO_3-HCl-H_2O$. O. R. Klemens. Oct. 2, 1959. Decl. Feb. 3, 1960. 14p. Contract AT(10-1)-205. OTS.

The corrosion behavior of 75A titanium in water-diluted and undiluted mixtures of reagent-strength nitric and hydrochloric acids has been investigated. These tests were at boiling temperatures in the immersed and vapor phases. The possibilities of hydrogen embrittlement and stress corrosion under test conditions were also investigated. Titanium weld studies were included. These tests were duplicated with Nichrome V present in the solution. (auth)

11928 MND-E-2008
Martin Co. Nuclear Div., Baltimore.
ERDL-NPFO—QUARTERLY PROGRESS REPORT NO. 10 [FOR] OCTOBER THROUGH DECEMBER 1959. C. Eicheldinger. Jan. 1960. 27p. Contracts DA-44-009-ENG-3581 and DA-44-192-ENG-6.

The corrosion loop operated at 90% utilization during this quarter. MOD SG-5 and SH-5 (Croloy 16-1) were removed from the loop after 4253 hours of testing without failure. MOD SG-6 and SH-6 (Inconel) were removed after 3819 hours of testing. Testing of MIN-6 (Croloy 16-1) was terminated after 2767 hours. Testing of MIN-8 (Inconel) was terminated after 5296 hours. Post-test evaluation was completed on MIN-4, MIN-5 (Croloy 16-1) and MIN-9 (Inconel). Very little corrosion product was noted in the secondary of the Inconel vessel. Engineering design was initiated on modifications to the corrosion loop. (For preceding period see MND-E-2007.) (auth)

11929 MSAR-60-47
MSA Research Corp., Callery, Penna.
STRESSED INCONEL PIPING IN A SEA WATER—WARM AIR COMPARTMENT. Technical Report 72. M. J. McGoff. Apr. 14, 1960. 10p. Contract NObs-77023.

Ten stressed 1-in. Sch 40 Inconel pipe specimens were exposed for 1000 hr in a high humidity sea water—warm air compartment. Constant temperature specimens were held at 400, 200, 165, and 125°F and cyclic specimens were varied between 550 and 125°F in a compartment where the ambient temperature was 125°F. The Inconel pipe specimens showed no evidence of stress corrosion by the high chloride atmosphere and pitting was not observed in an atmosphere which had caused corrosion of Type 304 ss. No quantitative measurements of corrosion rate were made. (auth)

11930 NP-8425
Battelle Memorial Inst., Columbus, Ohio.
THE CORROSION BEHAVIOR OF MONEL IN HIGH-TEMPERATURE WATER TO THE INTERNATIONAL NICKEL COMPANY, INC. Warren E. Berry and Frederick W. Fink. Oct. 15, 1958. 49p.

A study of the general corrosion behavior of Monel in primary water and in secondary water with the imposition of conditions which may be present in boilers was conducted. Experimental conditions included presence of chlorides (50 ppm), presence of oxygen (7 ppm maximum), stresses to 90% of room temperature yield strength, and the presence of crevices, welds, and galvanic couples. Procedures are outlined and results are discussed. Photomicrographs and charts are included. (J.R.D.)

11931
CATHODIC PROTECTION APPLICATIONS AT THE HANFORD WORKS. C. S. Bucholz (General Electric Co., Richland, Wash.). Applications and Ind. No. 46, 394-9 (1960) Jan.

Existing or proposed cathodic protection (CP) installations at Hanford are described. The soil has a very high resistivity, from 5 to 100 kohm-cm. Most of the original cast-iron, galvanized-steel, and carbon-steel underground piping installed in 1943 and 1944 is in good condition, but direct burial of unprotected stainless steel pipe has not been successful. The stainless steel lines now are encased in concrete ducts or are covered with a bituminous mastic to deter corrosive action. The anodes for the CP systems are made primarily of rails. Rectifiers rated at 24 v output are used to supply a current of 1 ma and a potential of −0.06 v. CP methods are presented for water storage tanks, reactor containment vessels, and reactor cooling water retention basins. (B.O.G.)

11932
THE OXIDATION AND CORROSION OF ZIRCONIUM AND ITS ALLOYS. (The Effect of Carbide Inclusions on Oxide Film Failure). B. Cox (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Corrosion 16, 188t-92t (1960) Apr.

The breakdown of the oxide films formed on carbon melted zirconium and Zircaloy-2 was studied using optical and electron microscopes. The nature of the breakaway process is illustrated and an explanation is offered for the effect of tin, iron, chromium and nickel alloying additions on corrosion resistance of carbon melted zirconium. (auth)

11933
OXIDATION BEHAVIOR AND PROTECTION OF REFRACTORY METALS. Chester T. Sims (General Electric Co., Schenectady, N. Y.). Corrosion 16, 193t-7t(1960) Apr.

Relative oxidation behavior and degree to which oxide properties affect the oxidation resistance of Nb, Ta, Mo, W, and Re are presented. Recent work in development of oxidation-resistant Nb and Ta alloys is reviewed and the current status of protection of Mo by cladding and coating discussed. (auth)

11934
THE EFFECT OF HALOGEN IONS ON THE CORROSION OF STAINLESS STEEL 18-8 IN SULFURIC ACID. Bao-din Khua, Sin-su Shen, Z. A. Iofa, and E. I. Mikhailova (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 130, 129-32(1960) Jan. 1. (In Russian)

Measurements were made of the rates of 18-8 stainless steel (9.3% Ni, 16.8% Cr, 0.14% C, 0.84% Mn, 0.05% Ti, 0.019% S, and 0.013% P) solubility in 10 N H_2SO_4 as functions of salt concentration (NaCl, KBr, and KI). The polarization curves in pure 10 N H_2SO_4 and with salt admixtures were plotted at room temperature. (R.V.J.)

11935
THE EFFECT OF THE CHROMIUM CONTENT ON THE ELECTROCHEMICAL BEHAVIOR AND RESISTANCE TO CORROSION OF IRON—CHROMIUM ALLOYS. G. M. Florianovich and J. M. Kolotyrkin (Karpov Scientific Research Inst. of Physics and Chemistry, USSR). Doklady Akad. Nauk S.S.S.R. 130, 585-8(1960) Jan. 21. (In Russian)

The influence of chromium content on iron—chromium alloy corrosion was determined by a potentiometric method combined with a colorimetric method of determining corrosion product concentrations in solution. The measurements were carried out in 0.1N sulfuric acid solution in a nitrogen atmosphere. Curves of dissolution rate as a function of chromium content were plotted for Fe—Cr alloys with 0.1 to 35% Cr and up to 0.4% Ni. An increased content of Cr increases the dissolution rate in sulfuric acid at potentials close to stationary and decreases it with intermediate potential values, especially at the transition point from 12 to 13% Cr. (R.V.J.)

11936

EFFECTS OF OXYGEN ON ELECTROCHEMICAL AND CORROSION BEHAVIOR OF 1X18H9T STEEL IN WATER AT CRITICAL TEMPERATURE AND PRESSURE. V. V. Gerasimov, A. I. Gromova, and E. T. Shapovalov. Doklady Akad. Nauk S.S.S.R. 130, 1089-90(1960) Feb. 11. (In Russian)

Anode and cathode polarization curves were plotted for 1X18H9T steel at 300°C and 87 kg/cm^2 pressure in distilled water saturated with hydrogen, air, and oxygen at partial pressures of 10 kg/cm^2. The stationary potential of 1X18H9T steel measured with hydrogen saturation was about −0.3 v, with addition of oxygen it shifted to the positive side and reached +4 v. A shift of the potential to the positive side (0.7 v) induced an increase in the rate of corrosion which remained uniform for all concentrations of oxygen. (R.V.J.)

11937

CORROSION RESISTANCE OF METALS IN ORGANIC REACTOR COOLING MEDIA. Jan Vorlíček and Vladimír Seifert (State Univ. of Transportation Engineering, Prague). Jaderná energie 6, 46-9(1960) Feb. (In Czech.)

The results of tests on the corrosive effects of diphenyl and methyl silicon oil on titanium, zirconium, steel, aluminum, and brass at temperatures up to 300°C and times of 250 to 1500 hours are given. (auth)

11938

THE CORROSION OF TITANIUM AND TITANIUM ALLOYS. O. Rüdiger, R. W. Fischer, and W. Knorr. Tech. Mitt. Krupp 14, 82-7(1956) Sept. (In German)

A survey of the corrosion chemical behavior of unalloyed Ti is given. The protective coating arising in various media was detected by electron diffraction diagrams, and the mechanism of the formation and dissolution of the protective layer is discussed. The voltage-time pattern of activated titanium in aqueous solutions and in air was determined, and the effect of water on the passivation of titanium was established. From current density potential measurements in 0.1 N fluoride-containing sulfuric acid the passivation potential was determined to be −0.6 v and the activation potential to be −0.4 v. The protective layer occurring in anodic polarization can be identified only partially. In potential-time measurements of titanium previously passivated in water, a secondary passivation was found in hydrochloric acid. This passivation layer, once formed, exists up to 100°C whereas the primary passivation layer is destroyed at 40°C. The upper temperature range for the formation of this secondary layer was determined by establishment of the equilibrium rest potential for various temperatures and hydrochloric acid concentrations. By oriented corrosion investigations the effect of alloying addition on the corrosion behavior of titanium was determined. An improvement of the corrosion resistance in hydrochloric, sulfuric, and phosphoric acids was established for a molybdenum addition. An alloy with 30% molybdenum shows a better resistance in these media than Hastelloy C. (tr-auth)

11939

THE OXIDATION OF TITANIUM. W. Kinna and W. Knorr. Tech. Mitt. Krupp 14, 99-104(1956) Sept. (In German)

Oxidation investigations were made on titanium at 800, 1000, and 1200°C in air and in oxygen at various oxygen pressures. The oxide layers produced at 800°C are TiO$_2$ with the rutile structure. At 1000 and 1200°C more layers are formed. The internal porous layers are TiO, Ti$_2$O$_3$, and TiO$_2$. The exterior, large-grained, porous-free layer is TiO$_2$ with a rutile structure. It was established that at 1000 and 1200°C the formation site of the TiO$_2$ layers is the TiO$_2$/gas phase boundary. This was explainable by the fact that both oxygen ions and titanium ions diffuse through the exterior oxide layer. The oxygen uptake of the metallic nuclei in the oxidation was determined by microhardness measurements and weighing. (tr-auth)

11940

THE THEORY OF PITTING AND EFFECT OF A CENTRIFUGAL FIELD ON THE PITTING CORROSION OF 18-8 CHROMIUM–NICKEL STEELS. W. R. Fischer. Tech. Mitt. Krupp 17, 137-45(1959) Sept. (In German)

A theory for the origin of pitting is given. On the active anodic pitting site, a halogen ion concentration, increased with respect to the solution interior, which is caused by halogen ion transport, was postulated. In these sites the corrosion was increased with respect to the usual cathodic surface region, since the corresponding current-voltage curve for the pits increases more rapidly than that for the usual cathode region. It was assumed that the halogen ions are concentrated immediately at the anodic metallic decomposition. For the case of 18-8 steel some investigations were carried out in chloride solutions in centrifugal fields which showed that at the anodic pits massive high chlorine ion liquid fractions must be present. These fractions were pressed by the centrifugal field on the sheet metal surfaces depending on the placement of the samples. On the underside of samples placed horizontally on the centrifuge vessel and on both sides of vertically placed samples a strongly decreased pitting corrosion was established. An exception is made for samples which were electrolytically polished. It was assumed that the pitting sites do not come directly in contact with the corroding medium, but that between metal and solution a thin gelatinous oxide or oxide hydrate layer with poor protective effect is present. This layer must let the chlorine ions pass through to the metal surface so that a high chlorine ion concentration can be built up. The specific massive liquid constituents adhere through this layer and can remove the effect of the centrifugal field. Agitating and ultrasonic effects lead, in mechanically polished 18-8 Cr–Ni steel, to significantly decreased pitting corrosion. As heavy liquid constituents under the selected conditions, only dissolved metal chlorides in increased concentration with respect to the solution interior are considered. This means that the resulting increased chloride ion concentration is given as a possible origin of the pitting corrosion. (tr-auth)

Fabrication

11941 ANL-5842

Argonne National Lab., Lemont, Ill.

THE FABRICATION OF A PLUTONIUM HELIX FOR A DOPPLER EXPERIMENT. Work completed: September 1956. R. J. Dunworth, H. V. Rhude, and L. R. Kelman. Feb. 1958. Decl. Mar. 15, 1960. 15p. Contract W-31-109-eng-38. OTS.

A helix constructed of plutonium was made to test the Doppler temperature effect in ZPR-III. The helix, 1 in. in diameter and $6\frac{1}{4}$ in. long, contained 240 g of delta-phase plutonium alloy encapsulated in titanium tubing. Four plutonium rods were extruded, joined together, and pushed into a titanium tube. This tube was swaged tightly over the plutonium rod, and the assembly was wound into a coil. Electrical leads to the coil were made by swaging copper tubing over the ends of the coil. The helix was tested by cycling about 500 times between 50 and 190°C. The coil was heated with a current of 130 amperes and cooled with a blast of chilled helium. Several helices of uranium were cycled during the same tests. Despite the severity of the thermal cycles, the helices were undamaged. (auth)

11942 DMIC-Memo-45
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
RECENT DEVELOPMENTS IN TITANIUM BRAZING.
G. E. Faulkner and W. J. Lewis. Mar. 4, 1960. 8p. (PB-161195). OTS.

A review of investigations concerned with brazing fillers which do not attack titanium is presented. Brazing methods, mechanical properties of brazed joints, and effects of brazing cycles on base-metal properties are also discussed. (J.R.D.)

11943 HW-23473
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ELIMINATION OF THE COLD OUTGASSING PERIOD FOR THE CASTING OPERATION. Final Report—Production Test 235-1. R. A. Carlson. Jan. 25, 1952. Decl. Mar. 15, 1960. 7p. Contract W-31-109-Eng-52. OTS.

Pu castings were made and evaluated after 16, 8, 4, 2 and 0 hours outgassing. Twenty-five pieces were processed in accordance with the test provision and nineteen were radiographed. For purposes of comparison, the data of three pieces outgassed at 16 hours were tabulated. A summary is presented of the total number of castings in each outgassing group which exhibited voids by radiographic examination. No deleterious effects on operating procedures or product quality resulted from the reduction of the outgassing time or its elimination. Evacuations to 10^{-4} mm. of Hg or less were made at the beginning and maintained throughout all casting cycles. Radiographs indicate that subsurface voids are eliminated during a subsequent pressing operation. (J.E.D.)

11944 HW-26141
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
BRIQUETTING OF MACHINED PLUTONIUM TURNINGS FOR RECYCLE TO THE CASTING OPERATION. Final Report—Production Test 235-6. B. A. Chandler. Nov. 7, 1952. Decl. Mar. 15, 1960. 10p. Contract W-31-109-Eng-52. OTS.

Twenty-four briquettes of Pu turnings were pressed in a He atmosphere and made into eight castings. Six castings were processed to final form and were comparable to normally processed material. Two castings were recycled due to causes other than briquetting. Casting yields, (wt. of casting/wt. of briquettes), were approximately 90%; approximately 10% of the Pu in the briquettes remaining in the melting and pouring crucible as skull. (auth)

11945 LA-1180(Del.)
Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF TECHNIQUES FOR ROLLING URANIUM METAL. D. E. Deutsch, G. S. Hanks, J. M. Taub, D. T. Doll, G. E. Jaynes, R. E. Anderson, V. Vigil, R. Osborn, and G. Sweeney. Nov. 15, 1950. Decl. with deletions Jan. 28, 1960. 128p. Contract W-7405-eng-36. OTS.

Uranium can be rolled from cast metal or forged ingot to sheet satisfactory for cupping, deep drawing, and similar fabrication procedures by a combination of hot breakdown in the neighborhood of 600°C and warm finishing at 225 to 325°C. Sheet may also be obtained by hot rolling alone and by warm rolling alone. However, it is difficult to secure a uniform, controlled grain size by hot rolling only and warm rolling is time consuming because of the limited reduction per pass obtainable. The combination of hot and warm rolling afforded the best and most practical method to secure good quality sheet in the quantity required. The percent reduction by hot working does not appear to be critical, but at least 60 percent warm reduction is desirable to obtain complete and controlled grain size by recrystallization with high ductility and strength properties. Except for research investigation, rolling of uranium below 225°C is not recommended. In the temperature range considered (below 225°C), reduction is difficult and must be limited to one to two percent if edge cracking is to be avoided. Hot rolling of unplated uranium from the as-cast or as-forged surface is recommended, using a bath of 35 percent Li_2CO_3 plus 65 percent K_2CO_3 for a heating medium. No further preparation other than washing the salt from the hot rolled surface is required before warm rolling, and a bath of Meltemp No. 7 oil is recommended for warm rolling. Work roll speeds and temperatures are not critical, and moderate to light reductions per pass are recommended for easiest rolling and best results. Alternate cross-rolling is recommended during hot breakdown, but continuous rolling in one direction during warm finishing is satisfactory. Starting with an as-cast tensile strength averaging 60,000 psi, as-rolled sheet up to 230,000 psi has been thus produced, with elongation averaging 5 to 8 percent and tensile to yield strength ratios averaging 75 percent. Uniform, equi-axed grains are produced upon annealing, and grain sizes can be controlled by choice of annealing temperature and time. (auth)

11946 MAB-139-M(M2)
National Research Council. Materials Advisory Board.
A SURVEY BY TASK FORCE ON CUTTING-TOOL MATERIALS. Second Progress Report by the Panel on Machining. Jan. 29, 1960. 37p. Contract DA-36-039-sc-76436.

Organizations most active in development of improved cutting-tool materials for machining aircraft and missile components were interviewed. Results of these interviews brought forth conclusions and actions which are expected to assist AMC Manufacturing Methods Division in development of machining and machine tools. Problems involved in machining new high-strength, heat-resisting materials are discussed and various recommendations, including an outlay by AMC of $250,000 for sponsored research on these methods, are listed. (J.R.D.)

11947 NAVSHIPS-392-0693
United Shoe Machinery Corp. Atomic Power Dept., Beverly, Mass.
SEAL WELDING AND CUTTING MACHINES. Technical Manual. Dec. 1958. 205p. Contract K-267.

Issued in loose-leaf form to facilitate periodic revisions.

The equipment comprising model S3G seal cutting machine is used to cut the seal welds of the model IB2 control drive mechanism in the S3G reactor. The equipment comprising model S4G seal welding machine is used to seal weld control drive mechanisms to the S4G reactor standpipes. A manual containing description, installation instructions, adjustments and tests, principles of operation, operating instructions and maintenance procedures for these machines is presented. (J.R.D.)

11948 NMI-2504
Nuclear Metals, Inc., Concord, Mass.
FABRICATION OF CLAD MASSIVE UO_2 FUEL ELEMENTS

BY HOT EXTRUSION. Monthly Letter Report for September. Oct. 9, 1959. 6p. OTS.

A new furnace design has provided temperatures of up to 4172°F without difficulty. Heating of a new core component, Design V, employing a thin graphite can threaded at the open end for a handle has been demonstrated at this temperature. Hot pressing and grinding of oxide bodies in quantity are being carried out. First trials of hydrostatic pressing were inconclusive. (W.L.H.)

11949 NMI-2505
Nuclear Metals, Inc., Concord, Mass.
THE FABRICATION OF CLAD MASSIVE UO_2 FUEL ELEMENTS BY COEXTRUSION. Second Quarterly Progress Report. F. S. Gardner and J. G. Hunt. Jan. 14, 1960. 34p. Contract AT(30-1)-1565. OTS.

Two potential types of metal-clad UO_2 rods were produced by coextrusion. The first type is stainless steel clad with an intervening graphite layer of 15 mils. The second type has a refractory metal cladding and no interlayer. Tantalum was used in the studies. Both of the above billet designs yield coextrusions having a potential rating of good. The O/U ratio of starting materials with satisfactory extrudibility was found to be between 2.00 and 2.10. By decreasing the temperature of the extrusion billet shell, the extrusion force increased to 400/600 tons which in turn increased extrusion pressures to 75/85 tsi. A corresponding change in apparent extrusion constant from 20/25 tsi to 30/35 tsi was noted. (For preceding period see NMI-2502.) (C.J.G.)

11950 NP-8447
Mallory-Sharon Metals Corp., Niles, Ohio.
THE ELECTRON BEAM MELTING OF BERYLLIUM, BORON, BORON CARBIDE, TANTALUM CARBIDE, TITANIUM CARBIDE, TUNGSTEN, AND ZIRCONIUM DIBORIDE. Quarterly Progress Report No. 7 [for] November 1, 1959–January 31, 1960. S. R. Seagle and O. Bertea. Feb. 1960. 17p. Contract AF33(616)-5603.

No further activity is reported in phase I; for information concerning activities in this phase see Quarterly Reports I through V. In phase II, beryllium extrusions were tested at elevated temperatures to determine the melting ratio and ductility. In phase III, a tungsten ingot hardness of 275 BHN is reported for a sample prepared by triple electron beam melting. Machinable hafnium ingots were produced by double electron beam melting; however, ingots produced by arc melting from sponge were brittle and could not be machined. Data on physical properties and chemical analyses of hafnium ingots are included. Data are also included on electron beam and arc melted vanadium ingots. In phase IV, procurement activities concerning elements for use in this phase are reported. (For preceding period see NP-8279.) (J.R.D.)

11951 TID-3546
Technical Information Service Extension, AEC.
WELDING AND BRAZING. A Literature Search. Theodore F. Davis, comp. Feb. 1960. 101p. OTS.

A list of 850 references to the report and published literature is presented. The subjects covered include welding, brazing, soldering, and bonding of materials of interest to the AEC. (W.L.H.)

11952 WVT-RI-5902
Watervliet Arsenal [Lab.], N. Y.
REDUCED PRODUCTION COSTS IN ORDNANCE WEAPONS BY PROJECTION WELDING. R. Robelotto and L. Chevaney. May 1959. 25p. Project title: IMPROVEMENT OF EXISTING METHODS FOR THE PRODUCTION OF CANNON.

The Cocking Lever and Trigger Arm for the 90 mm M41 Gun were fabricated from mild steel stampings and screw machine parts, using projection welding and brazing assembly methods. It is estimated that the application of projection welding to the fabrication of these components results in savings of approximately twenty dollars per gun. Dome type projections were found to be the best design for projection welding trunions, or lugs, to 1/4" plate. Optimum welding schedules were developed in order to minimize distortion and obtain a solid state bond. Average shear strengths of 6,800 to 24,000 pounds were achieved and average tensile strengths of 4,980 to 8,970 pounds were obtained. Brazing methods were developed to produce the offset cam surface at the upper end of the Cocking Lever. (auth)

11953 WVT-RI-5903
Watervliet Arsenal, N. Y.
FURNACE BRAZING OF THE 90 MM M41 COCKING LEVER. Keh-Chang Wu. May 1959. 15p. Project title: STUDY AND EVALUATION OF MANUFACTURING PROCESSES AND TECHNIQUES FOR CANNON.

A study was made to determine optimum brazing conditions for brazing the lug onto the 90 mm M41 cocking lever. Pure copper was used as the brazing material to obtain a joint which would withstand carburizing temperatures. Copper wire gave a stronger brazed joint than did copper shim stock. Specimens water quenched after brazing had higher strength than slow cooled specimens. Wire lengths less than 3.5 inches for brazing the lug to the lever resulted in a loss in joint strength. (auth)

11954 AEC-tr-4020
PROCESSES IN PRESSING METALLIC POWDERS. (Vorgänge beim Pressen von Metallpulvern). H. Unckel. Translated for Oak Ridge National Lab. from Arch. Eisenhüttenw. 18, 161-7(1945). 34p. (Includes original, 7p.). JCL.

Phenomena during compacting of metal powders were investigated in detail by experiments. The pressure distribution on the basis of the specific gravity and hardness, the wall friction, and the displacement of the powder particles during compacting are involved. A numerical formulation of the compacting process was attempted on the basis of results. (W.L.H.)

11955 CEA-tr-A-668
DISPOSITIF POUR LE SOUDAGE DE THERMOCOUPLES MINCES. (Apparatus for Welding Thin Thermocouples). H. Specht. Translated into French from Z. Metallk. 50, 36(1959). 5p.

A method is described for the welding of thermocouples by condenser discharge. By this method thermocouples of 0.03 to 0.1 mm in diameter can be prepared and welded on metallic surfaces. (tr-auth)

11956
NEW SURFACING METHODS VIE WITH OLD FOR HIGH-TEMPERATURE PROCESS APPLICATIONS. John R. Schley (Haynes Stellite Co., Kokomo, Ind.). Chem. Eng. 67, 184; 186; 188; 190(1960) Mar. 21.

These new metallic surfacing methods vie with the old in that they permit materials to be surfaced with small quantities of expensive, high-performance materials. These methods are flameplating, diffusion coating, hot-dipping, metallizing, hardfacing, and cladding and strip lining. Tables listing the respective surfacing material and its protective thickness, base material, maximum service temperature, and their most significant advantages are included. (B.O.G.)

11957
COATING COLUMBIUM FOR HIGH TEMPERATURES. G. Sandoz (U. S. Naval Research Lab., Washington, D. C.). J. Metals 12, 340(1960) Apr.

An investigation was conducted to find a coating for niobium to make it oxidation resistant. The results obtained at the U. S. Naval Research Laboratory using zinc as a coating are reported. Tests conducted on molten zinc dipped niobium with an intentional flaw after coating, revealed a moderate hardness increase near the flaw. No indication of oxygen absorption or other embrittlement after 5 hours at 2000°F was observed in the coated metal. (B.O.G.)

11958
FABRICATION OF A ZIRCALOY-2 IN-PILE PRESSURE TUBE. J. G. Goodwin (Westinghouse Electric Corp., Pittsburgh). Metal Progr. 77, No. 4, 93-6(1960) Apr.

Techniques used in the fabrication of a Zircaloy-2 in-pile pressure tube proposed for high temperature testing are discussed. A 968-lb. ingot was heated to 1800°F in a salt bath, then extruded using a mandrel faced with Stellite and a split, hot-work tool-steel die. Following extrusion, the machining was done by the Naval Gun Factory to the final dimensions ID-3.132 in., OD-4.525 in., and 22.375-ft long. Radiographic, fluorescent dye penetrant, and ultrasonic tests revealed no defects. The end cap and head assembly was welded on the tube in a helium atmosphere. Corrosion and mechanical tests were performed on samples of the ingot taken during the extrusion to determine the inherent characteristics of the finished tube. (B.O.G.)

11959
RECYCLING ZIRCALOY SCRAP. B. F. Rubin and R. F. Gessner (Westinghouse Electric Corp., Pittsburgh). Metal Progr. 77, No. 4, 97-100(1960) Apr.

A method is proposed for recycling Zircaloy scrap to regain the 80% loss during fabrication of reactor components. This scrap is comprised mainly of machine turnings, tailings and edge trims, and ingot crowns. The process proposed for the recycling of the Zircaloy scrap is presented. (B.O.G.)

11960
A REVIEW OF THE PRODUCTION OF MOLTEN ZIRCONIA IN THE SOLAR FURNACE. William M. Conn. Solar Energy 3, No. 3, 39-42(1959) Oct.

A review is presented of work done in the production of molten zirconia, m. p. 2710 ± 10°C. Three products of heating were obtained: partly vitrified original material; a clear or yellowish transparent, glass-like product; and a clear product containing many small crystals. The conclusion was drawn, based on x-ray-diffraction tests and the first precision measurement of thermal expansion, that zirconia forms, in addition to the monoclinic and tetragonal modifications, a trigonal modification and a glass. The results of all tests performed indicate that the samples show only crystalline structures. (B.O.G.)

11961
GRANULATION METHOD. (to U. S. Atomic Energy Commission). British Patent 832,309. Apr. 6, 1960.

A method and apparatus for granulating UO_2 ceramic materials prior to molding and sintering are described. The materials are milled in a mixture containing a volatile liquid and water so that drying to the desired water content is rapid. Screens and balls are used to form the granules while air flows upward through the system. An eccentric rotary motion is applied to the granulator. In an example, 6 cc of H_2O and 24 cc acetone were added to 300 g of ballmilled UO_2 with 1 wt.% polyethylene glycol binder and mixed. The wetted mass was mashed through a 10-mesh sieve onto the top sieve of the granulator. The granulator has a 20-mesh sieve, a 35-mesh sieve, and a spacer for air input, collector cone, and pan. The air flow was 1000 cc/min. The granules were dry, free-flowing, soft, and had a good size distribution. (T.R.H.)

Properties and Structure

11962 AD-205268
Brown Univ., Providence.
PHENOMENOLOGICAL THEORIES OF TIME EFFECTS IN METALS AT HIGH TEMPERATURES WITH SPECIAL REFERENCE TO PRIMARY CREEP. B. C. Hoskin. [1957?] 31p. Contract Nonr-562(20).

Several of the laws that have been suggested as adequate for describing the mechanical behavior of a metal at high temperature are reviewed. Attention is confined to the case of constant ambient temperature and uniaxial stress systems. Most consideration is given to the question of a law describing the deformation associated with so-called primary creep. (auth)

11963 AD-228359
Carborundum Co. Research and Development Div., Niagara Falls, N. Y.
DEVELOPMENT OF ULTRA REFRACTORY MATERIALS. Summary Report [for] November 1, 1958 through October 31, 1959. Peter T. B. Shaffer. Nov. 6, 1959. 61p. Contract NOrd-17175.

An investigation was made of refractory systems from which may be developed new oxidation-resistant, super-refractory materials. An oxidation furnace was operated for a short period at 3860°F, and continuously at 3540°F. A dilatometer, designed to protect the sample in an inert atmosphere was assembled, and after preliminary testing showed promise for use with oxidizable materials. A furnace for measuring modulus of rupture in inert atmospheres up to 3630°F was constructed. The pressurizable micro furnace for melting point and similar tests has been operated at 3990°F and 1000 psi. However, when operated under these conditions, over-heating of the upper shell occurred. Additional insulation or water-cooling will be installed. Two pieces of equipment, one to measure impact strength at temperatures up to 2730°F and the other to measure tensile strength at temperatures in excess of 3630°F are under construction. A dilatometer for use to approximately 5430°F is being designed. Hot-pressed composite bodies of zircon and zirconium diboride have been formed and have been shown to have excellent oxidation resistance and thermal shock resistance up to 3180°F. Composite bodies of zirconium diboride with either pentazirconium trisilicide or molybdenum disilicide have excellent oxidation resistance up to 3540°F. A relatively impure grade of zirconium diboride, prepared from zircon by means of a one-step process, has been shown to have better oxidation resistance than the very pure zirconium diboride hitherto studied. (auth)

11964 AFOSR-TN-60-152
Cambridge Univ., England. Cavendish Lab.
EFFECT OF STRAIN-RATE ON THE FLOW-STRESS OF f.c.c. METALS. First Annual Summary Report. P. B. Hirsch, T. E. Mitchell, and P. R. Thornton. Oct. 1959. 44p. Contract AF61(052)-98.

Results of an experimental study of the reversible flow-stress change which occurs when the strain-rate is increased by a factor of ten during a tensile test of a f.c.c.

metal are presented. Polycrystalline α brasses of three compositions (10, 20, and 30% Zn) and polycrystalline neutron irradiated Cu were studied as a function of deformation at 4.2 to 300°K. Single crystals of pure Cu and of 70/30 α brass were also studied in the same manner. These results show that, for alloys and irradiated Cu, in contrast to pure polycrystalline metals, the fractional change $\Delta\sigma/\sigma$ due to an increase in strain-rate is not independent of strain but decreases rapidly with increasing strain and becomes strain independent only at high strains. For single crystals the strain dependence of the quantity $kT\ln(\epsilon_1/\epsilon_2)/(\Delta\sigma/\sigma) = V\tau$ is given. For small strains $V\tau$ is small and independent of strain. As the strain is increased $V\tau$ increases rapidly with strain until at high strains it becomes strain-independent. A discussion of these results is given in which two interpretations are considered. The need for further experimental determinations of $\Delta\sigma/\sigma$ particularly at low temperatures, and for detailed studies of the dislocation distribution strain dependence as seen in the electron microscope is demonstrated. (auth)

11965 AFOSR-TN-60-193
Turin. Istituto Elettrotecnico Nazionale Galileo Ferraris.
MAGNETIC VISCOSITY AND ANNEALING IN MAGNETIC FIELD. THEORY OF THE MAGNETIC VISCOSITY DUE TO SOLUTE ATOM PAIRS. Technical Report 3 a. Giuseppe Biorci, Andrea Ferro, and Giorgio Montalenti. Nov. 1959. 106p. Contract AF61(514)-1331.

The magnetic diffusion viscosity due to the rotation of couples of solute atoms in alloys is studied. The relationship between annealing of alloys in a magnetic field and magnetic after-effect is established. A theory of the magnetic viscosity due to rotation of couples of solute atoms as an extension of the Néel theory of magnetic viscosity due to interstitial atoms is developed. (W.D.M.)

11966 ALI-C-62403
Little (Arthur D.) Inc., [Cambridge, Mass.]
A RADIATION TECHNIQUE FOR THE MEASUREMENT OF THE THERMAL CONDUCTIVITY OF SEMICONDUCTORS BETWEEN 1000 AND 2000°C. Progress Report Covering Period October 14, 1959 to March 1, 1960. Mar. 1, 1960. 29p. Contract Nonr-2974(00). OTS.

Experimental work on measuring thermal conductivity of semiconductors between 1000 and 2000°C is summarized. The assumptions regarding the semiconductors to be used in the tests, the instrumentation being developed, and the heat source that will be used are discussed in detail. The technique being developed consists of heating the sample with thermal radiation at one end, and measuring the energy reradiated at the other end. (W.D.M.)

11967 ARF-2131-9
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DEVELOPMENT OF COBALT-BASE ALLOYS. Final Report [for] September 1, 1958—October 31, 1959. John J. Rausch and Charles R. Simcoe. Feb. 4, 1960. 67p. Contract NOas-58-136-c.

The limit of forgeability was found to be at, or slightly beyond, the maximum solid solubility limit for any binary alloy addition to cobalt-base alloys. Alloys of Co with Fe, Mn, and Ni were forgeable in all proportions with the limit of forgeability at 15 wt.% Mo. Short-time tensile properties for binary alloys at room temperature and 1700°F are reported. Binary alloys were strengthened appreciably with additions of Mo, W, and Cr. Ternary alloys containing combinations of Cr, Mo, Nb, Ta, Ti, and W produced alloys with short-time tensile strengths of 60,000 to 85,000 psi at 1700°F. Significant additions of Si and Cr were found to produce oxidation-resistant complex alloys. Additions of Ti and Nb must be restricted to less than 3 wt.% in most systems if forgeability is to be retained. Additions of 8 wt.% Ta to the base Co- 15 wt.% Mo alloy increases the high-temperature strength while retaining good forgeability. (C.J.G.)

11968 AWRE-O-52/59
United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
EFFECT OF MECHANICAL WORKING (ROLLING) ON THE FATIGUE STRESS OF URANIUM. W. F. Biddle and R. Willows. Mar. 1960. 11p.

Fatigue tests were made on small specimens of magnesium-reduced uranium. In the cast state there was considerable scatter. Hot rolling 64% and annealing reduced the scatter considerably, while after 90% reduction and annealing the results were still more consistent and indicated a fatigue life of 32000 psi. Variations in surface finish had no observable influence on the results. (auth)

11969 BM-RI-5586
Bureau of Mines.
EFFECT OF ANTIMONY ON TENSILE PROPERTIES OF TITANIUM. J. D. Ramsdell and W. H. Lenz. Apr. 1959. 13p.

Antimony up to 10% increases the strength of Ti by solid-solution hardening. The general relationship of hardness, strength, and elongation in these alloys is similar to that found in several grades of high-purity and commercial Ti. For equivalent hardness and tensile strength, the Sb alloys showed a higher yield strength than unalloyed titanium without sacrificing ductility. Restriction of grain growth upon annealing is quite pronounced with 2% Sb or more and results in favorable combinations of yield strength and ductility. (W.L.H.)

11970 BMI-1417
Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF HIGH-STRENGTH NIOBIUM ALLOYS FOR ELEVATED-TEMPERATURE APPLICATIONS. John A. De Mastry, Frederic R. Shober, and Ronald F. Dickerson. Feb. 22, 1960. 24p. Contract W-7405-eng-92. OTS.

A study to improve the elevated-temperature strength of niobium by alloying has resulted not only in greatly improved strengths at 1200 and 1470°F but also in the development of improved fabrication techniques for these alloys. The most important step in the fabrication procedure of niobium and niobium-base alloys is the initial breakdown of the cast structure. The cast structure of 1.84 wt. % chromium, 3.21 wt. % chromium, 4.33 wt. % zirconium, and 20.5 wt. % titanium—4.28 wt. % chromium alloys and unalloyed niobium was broken down by forging ingots (protected from oxidation by molybdenum cans) at 2550°F and rolling at 800°F. After the initial breakdown of the cast structure, the alloys were cold rolled to a total of 95 per cent reduction with no difficulty. A second fabrication technique was employed for a second set of alloys. Unalloyed niobium and 1.29 wt. % chromium, 2.74 wt. % zirconium, 4.5 wt. % molybdenum, and 10 wt. % titanium—3 wt. % chromium alloys were forged and rolled at 1000°F to break down the cast structure and then cold rolled to 0.030-in. sheet. The sheet obtained by this technique showed moderate edge cracking. Tensile tests on the cold-worked materials at 1200 and 1470°F indicate that chromium and zirconium are both potent strengtheners of niobium: the 1.84 wt. % chromium alloy had a 0.2 per cent offset yield strength of 107,000 psi at 1200°F and 69,000 psi at 1470°F, and the 4.33 wt. % zirconium alloy had a 0.2 per cent offset yield strength of 69,000 psi at 1470°F. Limited welding studies indicate that strong and reasonably ductile welds can be produced both by arc and spot welding. (auth)

11971 CEA-1231
France. Commissariat à l'Énergie Atomique, Paris.
ETUDE PAR DIFFRACTION DES RAYONS X DE LA FORMATION DE LA PHASE γ' DANS LES ALLIAGES U–Mo. (Investigation Using X-ray Diffraction of the Formation of the γ' Phase in U–Mo Alloys). G. Donze and G. Cabane. 1959. 17p.

The decomposition of the γ phase of uranium-molybdenum alloys does not take place in the classical manner. The equilibrium products are not formed immediately after the start of the decomposition. The α phase is first precipitated and this liberates molybdenum which enriches the γ phase. When this γ phase is sufficiently enriched, it arranges itself so that the equilibrium product γ' appears. (auth)

11972 CEA-1261
France. Commissariat à l'Énergie Atomique, Paris.
ÉTUDE DES PROCESSUS DES TRANSFORMATIONS DANS LES ALLIAGES URANIUM–MOLYBDÉNE DE TENEUR 0,5 À 4 % EN POIDS DE MOLYBDÉNE. (A Study of Phase Transformation Processes Uranium–Molybdenum Alloys with 0.4 to 4% Molybdenum). Jeanne Lehmann. June 9, 1959. 71p.

Thesis submitted to Univ. of Paris.

Isothermal and continuous cooling transformation processes have been established in uranium-molybdenum alloys containing 0.5 to 4% Mo. Transformation processes of the β and γ solid solutions are described. These processes depend upon molybdenum concentration. Out of the β solid solution phase appears a eutectoid decomposition of β to $(\alpha + \gamma)$ or the formation of a martensitic phase α''. The γ solid solution shows a decomposition of γ to $(\alpha + \gamma)$ or $(\alpha + \gamma')$, or a formation of martensitic phases α' or α'_b. The U–Mo equilibrium diagram is discussed, particularly in low concentration zones. Limits between domains $(\alpha + \gamma)$ and $(\beta + \gamma)$, $(\beta + \gamma)$ and γ, $(\beta + \gamma)$ and β, have been determined. (auth)

11973 CEA-1270
France. Commissariat à l'Énergie Atomique, Paris.
ÉTUDE DES TRANSFORMATIONS PAR REVENU DE LA PHASE γ CUBIQUE CENTREÉ DES ALLIAGES URANIUM–MOLYBDÈNE. (Study of Transformation by Annealing of the Body-Centered Cubic γ Phase of Uranium–Molybdenum Alloys). Hubert Mikäiloff. June 23, 1959. 61p.

Thesis submitted to Collège de France, Paris. Conservatoire National des Arts et Métiers.

By annealing at different temperatures, a study was made of the transformations of the body-centered cubic γ phase for two alloys containing 6 and 10 per cent molybdenum by weight, respectively. There is a return to the equilibrium state by formation of the stable α orthorhombic and ϵ ordered tetragonal phases, following two types of reaction: pearlite transformation by nucleation and growth from the grain boundaries, preponderant when the annealing takes place at temperatures above 400°C, and identical for the two types of alloys. This reaction has already been studied by numerous authors, who have constructed the corresponding TTT curves; and transformation inside the grains of the quenched solid solution when annealing takes place at 400°C or below: 6 per cent alloy—precipitation of fine α phase particles, followed by progressive ordering of the solid solution enriched in molybdenum; 10 per cent alloy—formation of small ordered regions and then a fine α phase precipitate. In the course of this work particular attention was paid to the study of intragranular reactions after low-temperature annealing, the reactions involved in this case not having been explained up to the present. The γ phase transformation was studied by means of three techniques: micrography, microhardness tests, and x-ray diffraction. (auth)

11974 CEA-1317
France. Commissariat à l'Énergie Atomique, Paris.
APPLICATION DES MESURES DE MICRODURETE A L'ETUDE DES ZONES DE DIFFUSION. (Application of Microhardness Measurements to the Study of Diffusion Zones). V. Levy, P. Bouchet, J. Siouffi, and Y. Adda. 1959. 26p.

It is well known that the concentration fluctuations in diffusion zones can be determined by microhardness tests. It was therefore interesting to define the experimental conditions leading to the best accuracy. To this end, the influence of the kind of penetrator used and the applied load on the reproducibility of the curves plotting the variation of microhardness values against penetration was studied. This work, carried out for diffusion zones of various widths, enabled a determination in each case of the best experimental procedure. (auth)

11975 CMR-5-1365
Los Alamos Scientific Lab., N. Mex.
THE SOLUTION SUSCEPTIBILITIES OF REFRACTORY METALS IN MOLTEN PLUTONIUM. F. W. Schonfeld. June 16, 1952. Decl. Mar. 15, 1960. 9p. OTS.

The solution susceptibilities of molybdenum, titanium, vanadium, and zirconium in molten plutonium and in some molten plutonium alloys are given. Results from tests of over 9000 hr, indicate that vanadium may have the greatest resistance to dissolution. (J.E.D.)

11976 DMIC-126
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
STRUCTURAL DAMAGE IN THERMALLY CYCLED RENÉ 41 AND ASTROLOY SHEET MATERIALS. D. P. Moon, J. A. VanEcho, W. F. Simmons, and J. F. Barker. Feb. 29, 1960. 25p. Contract AF18(600)-1375. (PB-151083). OTS.

Stress-rupture life at 1650°F and tensile properties at room temperature and at 1400°F were used to determine the extent of structural damage in thermally cycled René 41 and Astroloy sheet materials. Solution-treated and aged René 41 was tested both in the heat-treated condition and after exposure to 10 or 100 thermal cycles between 1350 and 1750 or 1875°F. All of the conditions of thermal-cycling exposure caused at least some loss in the strength of this material. Metallographic examination indicated that over-aging was primarily responsible for the damage at 1750°F. Resolution of the $Ni_3(Al, Ti)$ precipitate and depletion of the alloy by surface oxidation were found to be the damaging mechanisms at 1875°F. Solution-treated and aged Astroloy was evaluated in the same manner in the heat-treated condition and after 10 thermal cycles between 1350 and 1875°F. No loss of strength was incurred by this exposure, but over-aging was observed and would probably have caused structural damage with further exposure. (auth)

11977 NAA-SR-4104
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
HEAT TRANSFER ACROSS ANNULI IN GAS BONDED URANIUM DIOXIDE FUEL ELEMENTS. J. W. Carroll and

C. A. Smith. Mar. 15, 1960. 38p. Contract AT-11-1-GEN-8. OTS.

The apparent thermal conductivity of UO_2 pellet, stainless steel clad, fuel element specimens with helium-filled annuli was measured. The helium gap between the pellets and cladding varied from 0.0035 to 0.0095 in. Due to unanticipated temperature drops in the experimental assembly, the effect of the helium annulus was uncertain. An improved experimental method is described, which would eliminate limitations in the present experiment, and should yield definitive results as to the effect of the size of the helium annulus. (auth)

11978 NAA-SR-4806
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ON THE MECHANISMS OF VOLUME SELF-DIFFUSION IN α-Fe AND γ-Fe. C. J. Meechan. Apr. 1, 1960. 10p. Contract AT-11-1-GEN-8. OTS.

Self-diffusion coefficients have been determined from sintering data for α-Fe at 885°C and for γ-Fe at 935°C. The respective values are $D_{885} < 6 \times 10^{-14}\ \text{cm}^2/\text{sec}$ and $D_{935} = 3.5 \times 10^{-13}\ \text{cm}^2/\text{sec}$. These values have been compared with results obtained previously from radioactive tracer measurements and it has been concluded that a ring mechanism of diffusion is dominant in α-Fe and a vacancy mechanism is dominant in γ-Fe. (auth)

11979 NAA-SR-Memo-2835
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RATES OF ALLOYING OF SRE METAL FUELS WITH THEIR JACKETS ABOVE 1600°F. R. S. Neymark. June 17, 1958. 12p. OTS.

In tests it was found that alloying between SRE metal fuels and the stainless steel jacket will occur, in the order of minutes, at interface temperatures of 1800°F or higher. The reaction does not appear to be fast enough (less than a minute) to cause reactor shutdown until the melting point of the fuel element is exceeded. Tabulated data and photomicrographs are included. (J.R.D.)

11980 NACA-RM-L57JO7a
Langley Aeronautical Lab., Langley Field, Va.
INVESTIGATION OF TANTALUM IN A 3,800°F SUPERSONIC AIRSTREAM. Otto F. Trout, Jr. and Jerry L. Modisette. Jan. 9, 1958. 13p.

An investigation was made of tantalum in still air and in a supersonic, high-stagnation-temperature air-stream to determine its resistance to oxidation at high temperatures. The results indicate that, except for a narrow range of temperatures, unprotected tantalum is not suitable for airframe parts exposed to air at high stagnation temperatures, because above this temperature range tantalum oxidizes or burns rapidly. (auth)

11981 NASA-TN-D-259
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
ROLLING-CONTACT FATIGUE LIFE OF A CRYSTALLIZED GLASS CERAMIC. Thomas L. Carter and Erwin V. Zaretsky. Mar. 1960. 36p. OTS.

The rolling-contact fatigue properties of a crystallized glass ceramic were investigated with the five ball fatigue tester. Fatigue spalls similar to those common in bearing steels were observed at maximum theoretical (Hertz) compressive stresses of 265,000, 295,000, and 300,000 psi. At room temperature, load carrying capacity was approximately one-fifteenth that of AISI M-1 tool steel. The effects of contact stress, contact angle, test lubricant, and test temperature up to 700°F are reported. This material may be useful in low-load, short-duration applications where an operating temperature above the limits of steels is the paramount design consideration. (auth)

11982 NASA-TN-D-269
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
INITIAL INVESTIGATION OF ARC MELTING AND EXTRUSION OF TUNGSTEN. Fred A. Foyle, Glen E. McDonald, and Neal T. Saunders. Mar. 1960. 35p. OTS.

Tungsten was vacuum arc-cast using direct-current reverse polarity to produce sound ingots. Arc-cast billets and sintered billets were extruded by both conventional low-velocity and high-velocity processes. Extrusion ratios as high as 45:1 were accomplished. Tensile properties of extruded tungsten, both arc-cast and sintered, are reported. (auth)

11983 NASA-TN-D-270
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
EFFECT OF HARDNESS AND OTHER MECHANICAL PROPERTIES ON ROLLING-CONTACT FATIGUE LIFE OF FOUR HIGH-TEMPERATURE BEARING STEELS. Thomas L. Carter, Erwin V. Zaretsky, and William J. Anderson. Mar. 1960. 52p. OTS.

The rolling-contact fatigue life of groups of AISI M-1, AISI M-50, Halmo, and WB-49 alloy steel balls tempered to various hardness levels was determined at room temperature. A continuous increase in fatigue life and load capacity of each steel was observed with increased ball hardness. These results did not correlate with elastic-limit and yield-strength measurements for bar specimens, which showed optimum values at an intermediate hardness; the results, however, did correlate with resistance to plastic deformation as measured with spherical specimens in rolling contact. (auth)

11984 NEPA-598
Northrop Aircraft, Inc., Hawthorne, Calif.
STABILITY OF BERYLLIUM OXIDE IN HYDROGEN AT ELEVATED TEMPERATURES IN THE PROGRAM ON THE STABILITY OF REFRACTORY ELEMENTS AND COMPOUNDS IN A HYDROGEN ATMOSPHERE AT ELEVATED TEMPERATURES. L. A. Ohlinger. May 26, 1948. 14p. [For Fairchild Engine and Airplane Corp. NEPA Div. Contract W-33-08-ac-14801(16250)]. (NRR-143).

Samples of BeO were subjected to a series of heat treatments to determine the stability of this material at elevated temperatures in a H_2 atmosphere. Comparable runs were made in a He atmosphere to isolate effects of heat from those of the reducing atmosphere. The results indicate that BeO as a structural refractory should be limited to temperatures below 1600°C. The tests also indicate the danger of utilizing C in contact with BeO when operating in H_2 at elevated temperatures. (W.L.H.)

11985 NP-8428
Syracuse Univ., N. Y. Research Inst. and National Advisory Committee for Aeronautics.
THE NOTCH SENSITIVITY OF HIGH TEMPERATURE ALLOYS. Literature Survey. G. Sachs and W. F. Brown, Jr. June 1957. 97p.

A review discussion is presented on notch sensitivity of alloys for high-temperature service. Fundamental effects of testing temperature and applied stress are considered first followed by the effects of test specimen variables such as section size and shape, notch depth and sharpness, specimen preparation, and loading eccentricity. Other variables such as heat treatment, chemical composition, vacuum melting, cold work, specimen direction, and welding and brazing are treated last. Extensive data tabulations are given for low alloy steels, Cr steels, Cr–Ni steel, Ni–Cr, Ni alloys, Co alloys, Al–Cu–Mg, and Sn–Cd. 65 references. (T.R.H.)

11986 NP-8450
Narmco Industries, Inc., San Diego, Calif.
DEVELOPMENT OF EXO-REACTANT INORGANIC ADHESIVE SYSTEM. Quarterly Progress Report No. 1 covering Period October 1–December 31, 1959. William Bassett and Roger A. Long. Jan. 1, 1960. 30p. Contract NOas-60-6061-c.

All successful bonds formed precluded the use of lap shear strength tests for comparison because bond strength was sufficient to cause tensile failure in the base metal. Reproducibly good bonding was achieved by ignition in a furnace with no auxiliary exotherm and with ignition by room temperature devices with an auxiliary exotherm. The feasibility of bonding with ignition by room temperature ignitors and with no auxiliary exotherm was also demonstrated. Both 17-7 PH hardenable stainless steel and 302 stainless steels were readily bonded, and an optimum copper bonding system was nearly developed. Optimum nickel bonding systems are in the process of being developed. (auth)

11987 NP-8468
Carnegie Inst. of Tech., Pittsburgh.
SELF DIFFUSION IN THE IRON–CHROMIUM SYSTEM. H. W. Paxton and T. Kunitake. Mar. 1, 1960. 31p. Project No. NR-031-184. Contract Nonr-760(08).

The self-diffusion coefficient of chromium in various alloys in the iron-chromium system has been measured. From the results obtained, and others in the literature, a general pattern of behavior is observed which is not consistent with present theories of diffusion by a vacancy mechanism. Some suggestions are made for further clarifying experiments. (auth)

11988 NP-8507
Westinghouse Electric Corp. Research Labs., Pittsburgh.
DEVELOPMENT OF NIOBIUM BASE ALLOYS. Quarterly Progress Report No. 2 for August 1, 1959 to November 1, 1959. R. T. Begley and A. I. Lewis. Feb. 15, 1960. 25p. Contract AF33(616)-6258.

The workability and mechanical properties of a number of niobium-base alloys were evaluated. A Nb–5 wt. % V–5 wt. % Mo–1 wt. % Zr alloy, tested in the fully recrystallized condition, had a 50,500 psi yield strength at 1093°C (2000 F). Preliminary data concerning the effect of oxygen on the mechanical properties of certain niobium base alloys were obtained. Oxygen additions appear to have a significant effect on the high temperature tensile properties of Nb–Hf and Nb–Ti–Zr–Hf alloys. Ternary phase diagram and welding studies continued. (For preceding period see NP-8392.) (auth)

11989 ORO-240(Vol. I)
National Carbon Co. Product and Process Development Lab., Fostoria, Ohio and National Carbon Co. Research Labs., Cleveland.
SUMMARY REPORT—PHASE I. GRAPHITE–MATRIX NUCLEAR FUEL ELEMENTS. VOLUME I. Dec. 22, 1959. 134p. Contract AT(40-1)-2560. OTS.

Data are presented on various aspects of the fabrication and the physical and chemical properties of graphite-matrix dispersion type fuel elements. These were prepared by the addition of UO_2 or ThO_2 to a carbonaceous mix followed by blending, forming, and baking with the final chemical form of the fuel (oxide or carbide) determined by the processing temperature. Studies were made of (1) methods of blending to achieve uniformity of dispersion of oxides of varying particle size and density, (2) the migration of uranium in high temperature processing, (3) the hydrolysis and oxidation of the carbides of uranium and thorium in a graphite matrix, and (4) the dependence of bulk density on fuel concentration at various processing temperatures. Studies were initiated on (5) the dependence on fuel loading and processing temperature of physical properties (electrical conductivity, thermal conductivity, coefficient of thermal expansion, and mechanical strengths) and (6) methods of testing the integrity of coatings on fueled graphite. The results of these studies confirm that graphite-matrix fuel elements represent a unique combination of fuel, moderator, and refractory structure which can be fabricated with properties of high thermal conductivity, low coefficient of thermal expansion and high strength over a wide range of fuel loading. (auth)

11990 SEP-217
Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.
EXPLORATORY STUDY ON ULTRASONIC INSPECTION OF HOT PRESSED URANIUM SLUGS. G. Thomas, H. McCullough, and J. L. Zambrow. Dec. 1, 1953. Decl. Mar. 7, 1960. 20p. (YE53S-522). OTS.

Ultrasonic vibrations as a method of non-destructive testing of U slugs were evaluated. The factors affecting transmission are variation in density, grain size, internal inclusions, and material structure. (F.S.)

11991 TID-5655
Illinois. Univ., Urbana.
MEASUREMENT OF THE EQUILIBRIUM CONCENTRATION OF LATTICE VACANCIES IN SILVER NEAR THE MELTING POINT. Technical Report No. 21. R. O. Simmons and R. W. Balluffi. Feb. 1960. 28p. Contract AT(11-1)-182. OTS.

Relative changes in macroscopic length, $\Delta L/L$, and x ray lattice parameter, $\Delta a/a$, of a 99.999% silver bar were measured at 14 to 956°C, using a rigid parallel pair of filar micrometer microscopes and a rotating-single-crystal x ray method. The expansions agree within experimental precision (about $1:10^5$) at the lower temperatures. At the higher temperatures $(\Delta L/L-\Delta a/a)$ progressively increases, showing that atomic sites are added, corresponding to the thermal generation of vacancy-type defects. The concentration of added sites, $\Delta N/N = 3(\Delta L/L-\Delta a/a)$, at the melting point (obtained by a 4° extrapolation) is $1.7 \pm 0.5 \times 10^{-4}$. This value is only 1/5.5 of the corresponding value found for aluminum by the same technique. For reasonable values of the binding energies of vacancy aggregates, it is concluded that more than 90 percent of these extra sites are present as single vacancies. For an entropy of formation of $(1.5 \pm 0.5)k$ an energy of formation for monovacancies of $1.09 \pm -.10$ ev is obtained. This formation energy is slightly larger than half the activation energy for self-diffusion, as similar measurements have shown for aluminum and lead, and as quenching experiments have indicated for gold. (auth)

11992 TID-5691
Syracuse Univ., N. Y. Research Inst.
PHASE EQUILIBRIA STUDIES OF SYSTEMS INVOLVING THE ALKALI AND ALKALINE EARTH METALS. Report No. IV. Frank A. Kanda and Aden J. King. Mar. 1960. 64p. Contract AT(30-1)-1910. (CHEM-1620.411P-6003R4). OTS.

The Li–Sr phase diagram was investigated as part of a series of diagrams between IA and IIA periodic main group metals. The crystal structures of Sr_3Li_2 and Sr_6Li_{23} were investigated and data are reported. The investigation of the calcium-rich end of the Ca–Mg system is virtually complete. Phase studies of the Ba–Na system are reported. A reinvestigation was made of the data reported for the Ca–Li system. (W.L.H.)

11993 WADC-TR-59-444
Case Inst. of Tech., Cleveland.
HYDROGEN EMBRITTLEMENT IN TERMS OF MODERN THEORY OF FRACTURE. P. A. Blanchard and A. R. Troiano. Aug. 1959. 30p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: EFFECT OF ENVIRONMENT ON THE INTERNAL STRUCTURE OF SOLIDS. Contract AF33(616)-6419. OTS.

An attempt was made to apply Cottrell's theory of brittle fracture to hydrogen embrittlement. A tentative explanation was given to the fact that only transition metals have been thus far embrittled by hydrogen. The influence of the composition of nickel base alloys on their susceptability to hydrogen embrittlement was discussed with the help of some previous and new experimental results. (auth)

11994 WADC-TR-59-445
Case Inst. of Tech., Cleveland.
THE LOWER CRITICAL STRESS FOR DELAYED FAILURE. E. A. Steigerwald, F. W. Schaller, and A. R. Troiano. Aug. 1959. 35p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: EFFECT OF ENVIRONMENT ON THE INTERNAL STRUCTURE OF SOLIDS. Contract AF33(616)-6419. OTS.

The lower critical stress was defined as the minimum stress necessary to produce the critical amount of hydrogen segregation required for crack initiation. A distribution law involving hydrogen concentration, applied stress, and temperature was assumed. On the basis of this law, the observed changes in the lower critical stress as a function of notch acuity, yield strength, temperature, and initial hydrogen content were explained for a significant range of these variables. (auth)

11995 WAL-TR-405-1/1
Watertown Arsenal Lab., Mass.
AN ENGINEERING EVALUATION OF NOTCH SENSITIVITY IN HIGH-STRENGTH SHEET MATERIALS. PHASE I. NOTCH TESTING. PHASE II. HYDRAULIC-BULGE TESTING. Period Covered: July 1957 to January 1960. George M. Orner and Carl E. Hartbower. Mar. 1960. 99p. Contract MIPR-30(600)-8-None-114. (AMC-TR-60-7-662). OTS.

The objective of this investigation was to evaluate titanium sheet produced under the Department of Defense Titanium Alloy Sheet Rolling Program for notch sensitivity. The feasibility of using an underwater spark discharge technique for bulge testing high-strength sheet materials at impact strain rates was investigated. (auth)

11996 WAL-TR-805/1
Watertown Arsenal Lab., Mass.
THE CHROMIUM–COLUMBIUM BINARY SYSTEM (thesis). John A. Misencik. Mar. 1960. 45p. DA Project No. 5B93-32-004. OTS.

Submitted to Massachusetts Inst. of Tech.

The complete binary system Cr–Nb was developed using metallographic, x ray diffraction, and thermal analysis techniques. Using thermal analysis, the existence of beta-chromium was confirmed and a eutectoid reaction, in the high chromium portion of the diagram, was found at 1550°C, in addition to the eutectic reaction at 1660°C. (auth)

11997 WAL-TR-832/1
RIAS. Div. of Martin Co., Baltimore.
EFFECT OF SURFACE COATINGS ON THE MECHANICAL PROPERTIES OF LITHIUM FLUORIDE CRYSTALS. Interim Technical Report. A. R. C. Westwood. Nov. 1959. 34p. DA Project No. 5B93-32-006. Contract DA-36-034-505-ORD-11-RD.

A study was made of the mechanical behavior of coated and uncoated lithium fluoride crystals. The coatings were produced either by vacuum deposition or by chemical reaction with pure magnesium oxide powder at 600 to 700°C. "Thin" coatings ($\ngtr 10\ \mu$ thick) increased the yield stress of as-cleaved crystals some 50% but had little effect on the yield stress of chemically polished crystals. At the critical resolved shear stress, catastrophic stress drops were observed with thinly-coated as-cleaved crystals and the subsequent rate of work hardening was less than that of uncoated as-cleaved crystals. Thicker reacted coatings ($\ngtr 50\ \mu$) increased both the yield stress and the flow stress of as-cleaved crystals (~60%) but stress drops were not observed. However, the stress and strain to fracture were reduced to half that of uncoated crystals. First cracks were always of the Stroh-type. An explanation for these results is offered based on considerations of the distribution of dislocation sources, and the piling up of dislocations at intersecting slip bands and beneath surface films. Metallographic evidence is presented for the pile-up of edge dislocations beneath surface films, at sub-boundaries and at intersecting bands of edge dislocations. (auth)

11998 AEC-tr-4019
INVESTIGATIONS WITH POROUS SINTERED ALLOYS ON A COPPER BASE. (Versuche mit Porösen Sinterlegierungen auf Kupfergrundlage). Hermann Unckel. Translated for Oak Ridge National Lab. from Z. Metallk. 36, 164-9 (1944). 25p. (Includes original, 6p.). JCL.

The strength characteristics of compacted and sintered bronze samples are investigated as a function of compacting pressure and sintering temperature. The pressure loss due to wall friction was determined. The suitability of various metals, in particular Zn, as hardeners for a Cu matrix in place of Sn was investigated. (W.L.H.)

11999 AEC-tr-4022
STRENGTH CHARACTERISTICS OF POROUS SINTERED IRON. (Festigkeitseigenschaften von Porigem Sintereisen für Lager). H. Unckel. Translated for Oak Ridge National Lab. from Arch. Eisenhüttenw. 18, 125-30(1944). 29p. (Includes original, 6p.). JCL.

Investigations were made of porous sintered Fe samples with respect to their density, Brinell hardness, tensile strength, upsetting behavior, notch impact strength, structure, and oil absorption. The influence of the composition of sintered Fe, additions, sample length, compacting pressures, sintering temperature, and sinter time on the characteristics was studied. (W.L.H.)

12000 AEC-tr-4030
THE PRODUCTION AND CERTAIN PROPERTIES OF A BORIDE OF HAFNIUM. J. B. Paderno, T. E. Serebriakova, and G. V. Samsonov. Translated by N. H. Krikorian (Los Alamos Scientific Lab.) from Tsvetnye Metally 32, No. 11, 48-51(1959). 5p. JCL or LC.

The boron carbide reduction of HfO_2 was the method used in the experiments in accordance with the equation for the reaction $2HfO_2 + B_4C + C \rightarrow 2HfB_2 + 2CO_2$ and with the reduction of HfO_2 by B for the production of the borides of the rare earth metals by the reaction $HfO_2 + 4B \rightarrow HfB_2 + B_2O_2$. The determination of the lattice parameter of HfB_2 gave values $a_0 = 3.137$ kX and $c_0 = 3.469$ kX. The determination of the physical characteristics of HfO_2 were made on compacts prepared by the method of hot pressing. (W.L.H.)

12001 AERE-Trans-844
THE NaF–BeF_2 SYSTEM AND ITS RELATION TO THE

$CaO-SiO_2$ SYSTEM. EXAMINATION OF SILICATE MODELS II. Erich Thilo and Hansjürgen Schröder. Translated by R. Todd (U.K.A.E.A. Atomic Energy Research Establishment) from Z. physik. Chem. (Leipzig) 197A, 39-62(1951). 27p.

The thermal phase diagram of the system $NaF-BeF_2$ is plotted for BeF_2 contents up to 61 mole %, and is compared with that for the system $CaO-SiO_2$. The two systems show a perfect model-relationship. Almost all the invariant points of the fluoride system (reckoned in °K) are converted to those of the silicate system by multiplying by 2.82. (For comparison of the systems $LiF-BeF_2$ and $MgO-SiO_2$, this factor has the value 2.88.) The following definite compounds were found and their melting points were determined: NaF 990°C, Na_2BeF_4 578, $NaBeF_3$ 372, $Na_3Be_2F_7$ (incongruent) 348°C. The eutectic $NaF-Na_2BeF_4$ at 31 mole % BeF_2 melts at 560°; and the $Na_3Be_2F_7-NaBeF_3$ eutectic (44.3 mole % BeF_2) melts at 340°. In the subsidiary system $NaF-Na_2BeF_4$, the compound Na_3BeF_5 (analogous to Ca_3SiO_5) was found to result from a solid-state reaction, and the γ- and β-modifications of Na_2BeF_4 were identified with certainty. Three further modifications were established with a high degree of probability, and the β- and α-modifications of $NaBeF_3$ were identified. The transition temperatures relating to all these modifications were determined. It is shown in the final section that the thermal decomposition of $(NH_4)_2BeF_4$ takes place in two stages; the intermediate product NH_4BeF_3, which is stable between 230 and 270°C, has a characteristic x-ray diagram. (auth)

12002 AERE-Trans-845

THE DIFFUSION OF XENON-133 IN URANIUM OXIDE OF VARYING OXYGEN CONTENT. R. Lindner and H. Matzke. Translated by J. B. Sykes from Z. Naturforsch. 14a, 582-4 (1959). 6p.

Data on Xe diffusion in UO_2 of varying oxygen content and in U_3O_8 at various temperatures are given. Continuous measurement of Xe escape was achieved by means of a circulation system containing Ar or Ar + H carrier gas. (J.R.D.)

12003 CEA-tr-A-662

SUR LE COMPORTEMENT DES ACIERS CONTENANT 11 À 20 POUR CENT DE Cr, TRAITÉS DANS LE DOMAINE DE LA FRAGILISATION À 475°. (The Behavior of Steels Containing 11 to 20% Cr, Treated in the Embrittlement Zone at 475°). E. Baerlecken and H. Fabritius. Translated into French from Stahl u. Eisen 78, 1389-94(1958). 35p.

Steels containing from 11 to 20% Cr were examined to determine to what extent their properties undergo modification in the embrittlement zone at 475°C during utilization. Bibliographic references and the results of annealing tests in this temperature zone and of tests on the strength, bending, elasticity, corrosion resistance, and magnetic properties show that the Cr content can not exceed 12.8% if embrittlement is to be avoided. A utilization of 100,000 hours was assumed. The critical quantity of Cr is reduced to 12% by the addition of some alloying elements. The reasons for the effects of certain alloying elements are still uncertain. High C concentrations lower the tendency to embrittlement, but metals such as Ti and Nb favor embrittlement. The effect of Mo on the embrittlement is superposed, at Mo contents higher than 1.9%, by a precipitation process with analogous effect. The temperature of maximum embrittlement decreases when the carbon concentration is lowered. (tr-auth)

12004 CEA-tr-A-678

QUELQUES ESSAIS SUR LA DIFFUSION DU Xe-133 DANS LES OXYDES D'URANIUM. (Some Tests on the Diffusion of Xe^{133} in Uranium Oxides). R. Lindner and H. J. Matzke. Translated into French from Z. Naturforsch. 13A, 794-6 (1958). 9p.

The diffusion of Xe^{133} in uranium dioxides was investigated on monocrystals with a well defined grain. After decay of the short-lived Xe isotope, samples of irradiated uranium oxide are placed in a quartz tube and the tube is then put in a furnace previously heated to a determined temperature. After a given time interval, the fission gas, after removal of the iodine, is then distributed throughout the experimental apparatus and measured. The specific activity of the Xe^{133} is determined by dissolving an aliquot portion of the sample and releasing the gas by heating. The results show that the Xe in the total volume is a function of the square root of time. The temperature function of the diffusion constant was also determined for U_3O_8. (J.S.R.)

12005 IGIS-70(RD/R)

ALUMINIUM IN REACTOR CONSTRUCTION. P. Eversheim. Translated by R. Pentland (U.K.A.E.A., Risley) from Atomwirtschaft 4, 155-9(1959). 11p.

The properties of aluminum and its alloys are reviewed with emphasis on those which meet the requirements for use in reactor construction. Corrosion characteristics are discussed and problems encountered in fuel element canning are examined. Radiation effects of neutrons are tabulated for various alloying materials. (J.R.D.)

12006 TT-864

THE KNIGHT SHIFT IN ALLOYS. (Déplacement de Knight dans les Alliages). J. Friedel. Translated by D. A. Sinclair (National Research Council of Canada) from J. phys. radium 16, 444-5(1955). 5p. JCL.

Recent calculations of electron density in alloys suggest that the Knight shift of the matrix nuclei is practically unaffected by the substitution of atoms in solid solution, even at comparatively high concentrations. (auth)

12007

THERMAL CYCLING AND STRAIN LOADING EFFECT ON URANIUM DEFORMATION. A. A. Bochvar, G. Ya. Sergeev, and V. A. Davydov. Atomnaya Energ. 8, 112-16 (1960) Feb. (In Russian)

It was found that thermal cycling α-phase uranium under continuous strain loading induces considerable residual deformation, exceeding several folds the total deformation without loading. The alterations in specimen dimensions were in the direction of the external forces. Thermal cycling α-phase uranium sheet produced shrinkage in specimens without applied loading. (tr-auth)

12008

A STUDY OF U–Ge SYSTEM. V. S. Lyashenko and V. N. Bykov. Atomnaya Energ. 8, 146-8(1960) Feb. (In Russian)

Constitution diagrams were plotted for 30 specimens of U–Ce with 99.66% pure U and 99.99% Ge as initial material. The alloys were subjected to homogeneous annealing in vacuum furnaces for 150 hours at 900°C. In addition, alloys with 45 to 75 wt. % Ge were annealed at 1350°C for 25 hours followed by 100 hours at 1000°C. All specimens were tempered at 720, 950, 1200, and 1300°C and quenched in oil. Five chemical states were observed in the diagrams; two crystallized from the melt, one formed as a peritectoid reaction, and the remaining two showed congruent and peritectic reactions. The maximum solubility of germanium in α and β uranium is ~1%; in γ uranium, ~3%. Uranium does not dissolve in germanium. The data indicate a similarity between the uranium–germanium systems and uranium–silicon and uranium–tin systems. (R.V.J.)

12009

UNIQUE PROPERTIES CAN PUT CERAMICS IN NUCLEAR REACTORS. PART 1. Leonard G. Wisnyi (General Electric Co., Schenectady, N. Y.). Ceram. Ind. 74, No. 2, 56-9; 69-70; 72(1960) Feb.

General concepts and properties of ceramic materials for use as fuels and controls in reactors are discussed. Ways in which ceramic fuels may be used in reactors are: (1) in high temperature gas cooled reactors where the fuel element is 100% ceramic; (2) in gas or liquid cooled reactors where a bulk ceramic core has a metallic cladding; (3) same as (2) with ceramic dispersed in a metallic matrix. Materials used for reactor controls must possess a high thermal neutron capture cross section, provide enough poison material for burnout throughout the core life, and during its life maintain the same blackness. At the present Eu_2O_3 shows promise as a ceramic control material, followed by B_4C, other metal borides, and possibly HfO_2. (B.O.G.)

12010

UNIQUE PROPERTIES CAN PUT CERAMICS IN NUCLEAR REACTORS. PART 2. Leonard G. Wisnyi (General Electric Co., Schenectady, N. Y.). Ceram. Ind. 74, No. 3, 77-9(1960) Mar.

Properties of ceramic materials used in burnable poisons in reactors and moderators are discussed. The most common burnable poison is B^{10}, used as a carbide, boride, or oxide. The basic properties of moderator materials are: (1) low atomic number, for slowing down power; (2) low neutron absorption, good moderating ratio; (3) monatomic, may have better radiation stability; and (4) solid, high temperature application. (B.O.G.)

12011

AN INVESTIGATION OF METALLIC COMPOUNDS FORMED IN THE REACTION BETWEEN A FIVE-COMPONENT SOLID NICKEL SOLUTION AND TITANIUM CARBIDE. R. B. Golubtsova and L. A. Mashkovich (Baĭkov Inst. of Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 130, 79-81(1960) Jan. 1. (In Russian)

The method of intermetallic analysis was employed to show that only two phases participate in the investigated multicomponent equilibrium systems: the pentavalent nickel solid solution and titanium carbide solid solution. (R.V.J.)

12012

AN INVESTIGATION OF METALLIC COMPOUNDS IN MULTICOMPONENT NICKEL ALLOYS CONTAINING NIOBIUM. R. B. Golubtsova and L. A. Nude (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 130, 318-21(1960) Jan. 11. (In Russian)

Intermetallic analysis of the composition and structure of alloys with various contents of niobium shows that multicomponent alloys form solid solutions with a Ni_3Nb metallic base. Microstructures of Al—Cr—Mo—Nb—Ni—Ti—W alloys were studied after thermal treatment at 1200°C for 200 hours followed by air cooling. Electrode potentials of Ni_3Nb intermetallics and γ solid solutions were measured with various electrolytes, and the effects of current on yield and composition are tabulated. The data show that the Ni_3Nb base compound (phase yield 16.3%) is segregated at + 18 to 0°C. Along the side the Ni_3Nb phase at −8°C a solid solution is formed which somewhat increases the phase yield. In all alloys the segregated phase appears as solid solution Ni_3Nb with a rhombic crystalline lattice. Considering the crystal radii, it is assumed that Cr (1.28A) atoms replace the Ni (1.24A) and W (1.41A), and Mo (1.40A) atoms replace Nb (1.47A); thus the formula of the complex can be expressed as $(Ni, Cr)_3(Nb, W, Mo)$. The investigation also establishes the quantity and content of Ni_3Nb and γ solution in various alloys. (R.V.J.)

12013

"PENOSIL," A NEW THERMOINSULATING MATERIAL RESISTANT TO HEAT. I. I. Kitaĭgorodskiĭ and N. V. Artamonova. Doklady Akad. Nauk S.S.S.R. 130, 377-8(1960) Jan. 11. (In Russian)

The preparation and thermal resistance of "Penosil" are described. (R.V.J.)

12014

ELECTRIC PROPERTIES OF BORIDES OF RARE-EARTH METALS. G. V. Samsonov and Yu. B. Paderno (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 11, 1215-18(1959). (In Ukrainian)

The electric and thermoelectric properties of borides of several rare earth metals were investigated. It is shown that in the region from room temperature to 700 to 800°C the materials are metallic conductors with hole conductivity. Methods were developed to obtain pseudobinary alloys of hexaborides with high electric resistance and small work-function of electrons. (auth)

12015

THE NERNST—ETTINGSHAUSEN EFFECT IN NICKEL AND Fe—Ni ALLOYS AS A FUNCTION OF TEMPERATURE. R. P. Ivanova (Lomonosov Moscow State Univ.). Fiz. Metal. i Metalloved. 8, 851-6(1959) Dec. (In Russian)

The Nernst—Ettingshausen effects in nickel and nickel—iron alloys were studied for a wide range of temperatures. The influence of a magnetic field up to ~1600 gauss, temperature (from 100 to 400°C), and composition on the electromotive force was measured using specimens of 36% Ni—64% Fe; 45% Ni—55 Fe; 55% Ni—45% Fe; 65% Ni—35% Fe; 75% Ni—25% Fe; 85% Ni—15% Fe; and 100% Ni. (R.V.J.)

12016

EFFECTS OF STRUCTURE AND TEMPERATURE OF DEFORMATION ON PHASE TRANSFORMATION IN PLASTIC DEFORMATION. B. A. Apaev and Yu. A. Sysuev (Gor'kov Research Inst. of Physics and Tech., USSR). Fiz. Metal. i Metalloved. 8, 915-21(1959) Dec. (In Russian)

Magnetograms are plotted for various thermal treatments of U—12 and U—10 steels. (R.V.J.)

12017

DETERMINATION OF SPECTRAL EMISSIVITY OF CERAMIC BODIES AT ELEVATED TEMPERATURES. G. Richard Blair (McMillan Lab., Inc., Ipswich, Mass.). J. Am. Ceram. Soc. 43, 197-203(1960) Apr.

A rapid and very simple technique using induction heating is reported for obtaining the spectral, or total, emissivity of a ceramic material up to its melting point. The measurement system employs a PbS detector, in conjunction with a sensitive galvanometer. Spectral emissivity data are shown for several alumina bodies and for three rare-earth oxides, erbium, samarium, and gadolinium, up to 1700°C. (auth)

12018

URANIUM OXIDE CLEAVAGE. R. G. Robins and P. J. Baldock (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Am. Ceram. Soc. 43, 228(1960) Apr.

Results of a study of the cleavage of uranium dioxide crystals are presented. Previously a synthesized uranium dioxide crystal was found to have no cleavage. Here it was proven that uranium dioxide was cleaved both mechanically and by self-cleavage by controlled oxidation. A Laue x-ray back reflection study revealed cleavage in the $\{1\,1\,1\}$ planes. (B.O.G.)

12019

NEW IRON-BASE HIGH-TEMPERATURE ALLOY? G. K. Manning (Battelle Memorial Inst., Columbus, Ohio). Metal Progr. 77, No. 4, 117-19(1960) Apr.

Hot hardness curves were obtained for iron alloys containing 20% chromium with nickel, niobium, and carbon. These curves suggest excellent high-temperature strength. The hot hardness and composition curves are given for several alloys. The microstructures of the best austenitic and ferritic alloys are given for specimens which were heated for two hours at 2300°F, then water quenched. (B.O.G.)

12020

THE CREEP STRENGTH OF SOME HIGH TEMPERATURE ALLOYS AT 1,050°–1,200°C. H. C. Child, A. B. Collier, and C. F. West (Jessop-Saville, Ltd., [Sheffield, Eng.]). Metallurgia 61, 51-4(1960) Feb.

The results of creep tests on austenitic steels in the temperature range 1,050 to 1,200°C are tabulated. Extensiometry problems were overcome by the use of cantilever specimens. (D.E.B.)

12021

DIFFUSION OF Th AND DESTRUCTION OF Th–W ELECTRODES IN A HEAVY CURRENT DISCHARGE IN Xe. R. E. Rovinskii and M. V. Samoilenko. Radiotekh. i Elektron. 4, 1018-25(1959) June. (In Russian)

The diffusion process in Th–W electrodes and the role of the diffusion on electrode performance in high-current discharge in xenon were determined by means of thorium α radioactivity. The diffusion factor was derived and correlated with Langmuir data. The results indicate that thorium diffuses between the grains of tungsten. The thorium impoverishment is one of the main factors affecting performance, causing destruction of the electrodes. (R.V.J.)

12022

CONCERNING THE THEORY OF THE SCATTERING OF X-RAYS AND THERMAL NEUTRONS BY MULTICOMPONENT SUBSTITUTIONAL ALLOYS. A. A. Smirnov and E. A. Tikhonova (Metal Physics Inst., Kiev). Soviet Phys.-Solid State 1, 1277-84(1960) Mar.

The effect of the geometrical distortion of the lattice caused by the different radii of atoms of different components on the scattering of x rays and slow neutrons by multicomponent disordered substitutional alloys is considered. The elastic continuum model is used. The dependence on concentration of both the intensity of the directly reflected component, as well as of the background intensity, for the scattering of monochromatic radiation by a single crystal, is investigated. The particular case of binary and ternary alloys is considered. (auth)

12023

THE ENGINEERING TITANIUM ALLOY Ti–6Al–4V, ITS PROPERTIES AND HEAT TREATMENT. W. Knorr. Tech. Mitt. Krupp 14, 88-98(1956) Sept. (In German)

The property changes caused by heat treatment in Ti–6% Al–4% V are described, and the effect of a high alloy addition was investigated. The tensile strength increases on quenching at 800°C and attains a value of 120 kg/mm^2 with good expansion and contraction at quenching temperatures between 900 and 950°C. The yield point and yield point ratio pass through a minimum at 800 to 850°C. By annealing at 500°C the yield point is increased, and the tensile strength is also increased but to a lesser degree. A maximum tensile strength can only be obtained with small sample dimensions since the resulting cooling velocity is very great. With higher β constituents the hardness of the alloy can be increased. A too high content of β stabilizing elements causes a decrease of the ductility, and the stability of these alloys is lower. The properties of the alloy at higher temperatures are better than in other commercial titanium alloys. A molybdenum addition leads to a great improvement of the heat strength in the tempered state. (tr-auth)

12024

THE NOTCH IMPACT STRENGTH OF TITANIUM. O. Rüdiger and W. Knorr. Tech. Mitt. Krupp 14, 105-13 (1956) Sept. (In German)

The effect of the sample form on the notch impact strength of unalloyed titanium was described, and the relationship between various sample forms is represented schematically. The notch impact values given in the literature were reduced to values for the DVM sample and compared with suitable measurement results. The effect of impurities on the temperature pattern of the notch impact strength was discussed; the effect of the grain size after various heat treatments is also discussed. The effect of hydrogen on the notch impact strength of unalloyed titanium was investigated on two melts of different purities. The different behavior of titanium and titanium alloys with diverse deformation velocities is indicated. (tr-auth)

12025

EXPOSURE DIAGRAMS FOR X-RAY COARSE STRUCTURE PHOTOGRAPHS ON TITANIUM. G. Schuhmacher. Tech. Mitt. Krupp 14, 114(1956) Sept. (In German)

Exposure diagrams were obtained for motion pictures with x-ray beams with and without amplifier foils on unalloyed titanium. The diagrams can be used as an indication of the correct values of the exposure necessary for titanium. The investigations showed that sections of unalloyed titanium up to a thickness of about 30 mm could be irradiated by the utilization of a fine focusing tube without foils. Thicknesses beyond this required voltages over 100 kv and very long exposure times.

12026

THE VARIATION OF THE MECHANICAL AND TECHNOLOGICAL PROPERTIES OF TITANIUM WIRES IN COLD DRAWING. A. Pfützenreuter. Tech. Mitt. Krupp 14, 115-20(1956) Sept. (In German)

The present measurements on the variations of the mechanical and technological properties of titanium wires in cold drawing showed that the solidification behavior is approximately equivalent to that of a ferritic steel. The titanium wire is superior to stainless steel in many technological properties (torsibility and flexibility). The solidification of V2A is about 2.5 times as large as in titanium. (tr-auth)

12027

TEMPERING OF TITANIUM ALLOYS. TEMPERING AND RECOVERY OF TITANIUM–VANADIUM ALLOYS. W. Knorr. Tech. Mitt. Krupp 15, 178-93(1957) Dec. (In German)

The tempering behavior of binary titanium–vanadium alloys with 12, 15, and 18% vanadium was investigated. After formation of the ω phase the hardness of the alloy with 15% V increases in quenching after incandesence in the β region; the alloys with 12 and 18% V form no quenched ω phase. On annealing between 200 and 400°C, the hardness increase is the fastest in the 15% alloy, whereas in the 12 and 18% alloys the hardness increase is slower. From the annealing isotherms an activation energy of 32,000 cal/mole was obtained. At the start of the precipitation the hardness shows an instability. Dilatometric measurements indicate that the ω formation occurs in several stages. Microscopic investigations show that an α precipitation, which arises at impurity and lattice perturbation sites, runs parallel in the region of the ω formation. The $\omega \rightarrow \alpha$ transition was displaced to an earlier time. At temperatures over 400°C a rapidly occurring recovery sets in. At 550°C the ω phase formed in the annealing recovers completely, but the ω phase formed in quenching is only partially restored. The restoration increase with increasing restoration temperature. The aging time and temperature appear to have no effect on the recovery. After a brief recovery time the β crystals formed are completely hardenable, but with longer recovery α precipitation sets in and the hardenable β mixed crystals decrease. The α precipitation connected with the recovery is bound to a low hardness increase. In cold deformation the hardening is accelerated by ω formation. The subsequent α precipitation sets in also in unprocessed samples. After cold working, the hardness is recoverable. The reprecipitation leads to a smaller hardness increase since the α precipitation is accelerated after recovery following preliminary cold working. (tr-auth)

12028

THE ELECTROCHEMICAL INVESTIGATIONS ON UNALLOYED TITANIUM AND THE ALLOY TiMo30. O. Rüdiger and R. W. Fischer. Tech. Mitt. Krupp 15, 194-202(1957) Dec. (In German)

Unalloyed titanium was corroded in the active state by corrosive media with simultaneous exposure to hydrogen. By anodic oxidation passivation occurs in hydrofluoric acid media. This is aggravated by increase of the hydrofluoric acid concentration and by agitation. In the passive state the corrosion remains quite intense in hydrofluoric acid since the residual current density in the passive state is relatively high. Breakdown phenomena on passivated titanium, which lead after disturbance of the passive layer to a local limited corrosion, occur in chloride, bromide, iodide, and fluoride solutions at higher potentials. The height of the breakdown potential is dependent on a series of factors such as the temperature, concentration, and the agitation of the electrolyte. Whereas iodide ions breakdown the passive layer, under certain conditions, at under +1 v, fluoride ions need over -50 v. For bromide ions the breakdown potential is in the region of +1.5 to +3 v, and for chloride ions between +10 and +15 v. The corrosion of unalloyed titanium in the active state is also considered. In the alloy Ti–30% Mo the proportions are directly opposite. The corrosion beyond the breakdown potential is considered. Only in hydrofluoric acid solutions does activation occur so that the alloy is dissolved under the attack of hydrogen. (tr-auth)

12029

PROPERTIES AND HEAT TREATMENT OF THE TITANIUM ALLOY TiAl7Mo4. W. Knorr. Tech. Mitt. Krupp 17, 111-23(1959) Sept. (In German)

The properties of a titanium alloy containing 7% Al and 4% Mo were investigated. In the incandescent state, tensile strengths between 104 and 124 kp/mm^2 were found. The effect of deformation on the tensile strength and the effect of the deformation degree and the deformation temperature on the ductility are greater than the effect of a change of the alloy composition in the concentration range investigated. The tensile properties can be increased by heat treatment so that a good depth hardness can be obtained. The yield point, with increasing quenching temperature, passes through a minimum value at approximately 900°C which is apparent with the transformation of the mechanically stable β phase. Favorable combinations of strength and ductility were obtained after quenching from 900°C and annealing at 550°C. The structural forms arising in the processing and from heat treatment and their relationship with the mechanical properties are described. The best properties at room temperatures have a polygonal $(\alpha + \beta)$ form which was obtained with final deformation at the lowest temperature possible. This fine-grained state possesses, however, relatively poor creep properties, but transformation yields improved values. Some time-state values at 400 and 500°C show a relatively high heat resistance for titanium alloys. The embrittlement observed at 500°C raises doubts as to the utilization of the alloy for extended use at temperatures over 400°C. (tr-auth)

12030

INVESTIGATIONS ON THE TITANIUM ALLOY TiMo6Al3. W. Knorr. Tech. Mitt. Krupp 17, 124-9(1959) Sept. (In German)

The mechanical properties of a titanium alloy with 6% Mo and 3% Al under varying heat treatments and its tempering behavior were investigated. After quenching from 800°C, the alloy has a minimum hardness and yield point. In annealing at 400°C the hardness and strength reach a maximum but the ductility is very low. At higher annealing temperatures between 450 and 600°C a good combination of strength and ductility was obtained. The yield point ratio at the state of the minimum yield point is 0.54%. It is increased to about 90% by the annealing treatment. The tensile strength is between 110 and 130 kp/mm^2. The alloy in the quenched state has a high symmetrical expansion which is of significance for cold working. The structural synthesis and the course of the precipitation in annealing were followed with optical and electron microscopes. (tr-auth)

12031

MATERIALS IN ENERGY CONVERSION SYSTEMS. J. M. Allen (Battelle Memorial Inst., Columbus, Ohio). Presented at the ARS 14th Annual Meeting, November 16-20, 1959, Washington, D. C. New York, American Rocket Society, 1959. 11p.

The problems of determining the properties of materials to be used in the energy conversion systems of space vehicles and the compatibility of these materials with other materials being used are discussed. Topics considered include thin-film structures, heat storage, working fluids for thermomechanical systems, and protective coatings. (C.J.G.)

12032

Raytheon Mfg. Co., Waltham, Mass.
PYROGRAPHITE. RAYTHEON INTRODUCES A NEW HIGH TEMPERATURE MATERIAL. [1960]. 14p.

The structure, properties, and fabrication process of pyrographite are given. The performance of pyrographite in various test environments is discussed. (C.J.G.)

12033

IMPROVEMENTS IN OR RELATING TO GRAPHITE MODERATOR UNITS. Ian Alexander Butler Gaunt (to General Electric Co., Ltd.). British Patent 831,547. Mar. 30, 1960.

A graphite block design is offered for reactor construction. It has a channel hole and prevents coolant leakage and Wigner distortion. (T.R.H.)

Radiation Effects

12034 AD-219800
Stanford Research Inst., Menlo Park, Calif.
EFFECT OF RADIATION ON THE MECHANICAL PROPERTIES OF PLASTICS. Quarterly Progress Report No. VI [for] February 15, 1959—May 15, 1959. David L. Chamberlain, Jr. June 1, 1959. 23p. Project No. TB4-721. Contract DA-04-200-ORD-698.

The effects of radiation upon the viscoelastic properties of polyethylene were investigated. (W.L.H.)

12035 AD-228813
Stevens Inst. of Tech., Hoboken, N. J.
UNCLASSIFIED LITERATURE SURVEY ON THE EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS. Report No. 9. [Period covered]: June 1, 1959 to August 31, 1959. E. R. Johnson. 17p. SC Project No. 112B. Contract DA-36-039-SC-73146.

Experimental techniques for studying radiation damage are reviewed with emphasis on electron tube materials. Radiation damage to thin films and field emission cathodes is discussed, and preliminary information on damage to ceramic-type tubes is included. (J.R.D.)

12036 AD-228837
Edgerton, Germeshausen and Grier, Inc., Boston.
A STUDY OF RADIATION EFFECTS ON ELECTRONIC DEVICES. Third Quarterly Report [for] July 1, 1959 to August 31, 1959. Harold S. Sauer. Oct. 1, 1959. 12p. DA Project No. 3-19-01-701. Contract DA-36-039-SC-78171.

The radiation effects data recording system, completely described in AD-312143, dated July 1, 1959, has remained essentially unchanged. A portion of the system was installed in a military 6 × 6, which was transported to two nuclear reactors (Godiva at the Los Alamos Scientific Laboratory and TRIGA at the General Atomics Corporation) for radiation tests. The system was proven satisfactory and significant test data were obtained. (auth)

12037 AD-229344
Admiral Corp., Chicago.
EVALUATION—DEVELOPMENT OF MIL-C-14157 CAPACITORS FOR NUCLEAR RADIATION ENVIRONMENT. Scientific Report No. 1. E. R. Pfaff. Oct. 22, 1959. 23p. Contract Nobsr-77612.

The experimental procedures being employed for evaluating the radiation damage to the CPM-08 capacitors are discussed. The radiation environment is produced by a 20,000 curie Co^{60} source. The capacitors are to be subjected to gamma fields of approximately 10^5 R/hr. for 1000 hours. Initial tests show that the kraft dielectric tissue becomes brittle and gas evolution is associated with the mineral oil impregnant. (auth)

12038 AD-229629
Detroit Arsenal, Centerline, Mich.
THE EFFECTS OF IONIZING RADIATION UPON TRANSPARENT MATERIALS. Gregory Arutunian and Fred L. Seppi. Oct. 26, 1959. 38p. Project No. TW-789(606). (RR-1).

Transparent materials, normally employed in vehicular viewing systems, were irradiated to determine how ionizing radiations affect their optical transmission. Commercial-grade glass, polystyrene, plexiglas, allyl carbonate, and polyvinyl acetate were exposed to x-rays ranging in energy from 50 to 150 KVP for differing lengths of time. Curves of spectral transmittance were plotted as a function of x-ray dosage. As a result of radiation, materials containing doubly bound oxygen atoms exhibited the greatest coloration and exhibited a greater loss in transmittance in the blue region of the visible spectrum than in the red. Polystyrene, an oxygen-free aromatic hydrocarbon, was least affected by x-rays and, on the basis of retention of optical transmission, can be considered for vehicular optical viewing systems exposed to intense gamma radiation or x rays. (auth)

12039 AFOSR-TN-59-1315
Turin. Istituto Elettrotecnico Nazionale Galileo Ferraris.
THEORY OF THE ISOTHERMAL BLEACHING OF F CENTERS PRODUCED BY IRRADIATION IN ALKALI HALIDES. Technical Note No. 3 d. Guido Bonfiglioli, Piero Brovetto, Cesare Cortese. [1959]. 15p. Contract AF61 (514)-1333.

The same model used in the previous notes to quantitatively interpret thermoluminescence of irradiated alkali halides, is applied to account for the experimental results on thermal bleaching of the optical density in the same materials. The present calculation does fit remarkably well with experiment, showing that the presence of several species of V-Centers was actually responsible for the interpretation difficulties which, so far, characterized this subject. The major emphasis was put on the theoretical work. Partial experimental results are discussed. (auth)

12040 BMI-1406
Battelle Memorial Inst., Columbus, Ohio.
RADIATION EFFECTS ON BORON-CONTAINING COMPOUNDS. Donald J. Hamman and Paul Schall. Jan. 6, 1960. Decl. Mar. 4, 1960. 24p. Contract W-7405-eng-92. OTS.

Elemental boron, boron carbide, and zirconium diboride were irradiated at reactor ambient temperature (150°F) and elevated temperatures (500 to 750°F) to burnups ranging from 20 to 95 per cent of the boron-10 isotope. Zirconium diboride containing both natural and enriched amounts of boron-10 was evaluated. The amount of helium released during irradiation was measured, and x ray diffraction, metallographic, and chemical examinations were performed before and after irradiation. Zirconium diboride containing natural boron appeared to be the most promising material from a helium-retention standpoint. None of the materials exhibited excessive particle fragmentation or dimensional changes during the course of the experiments even though there was evidence of temperatures much higher than design conditions. (auth)

12041 CRMet-904
Atomic Energy of Canada Ltd., Chalk River, Ont.
IRRADIATION BEHAVIOUR OF ENRICHED U_3Si ELEMENTS SHEATHED IN ZIRCALOY-2. L. M. Howe. Jan. 1960. Appendix I: ANALYSIS OF RADIOCHEMICAL RESULTS FOR U_3Si SPECIMENS IRRADIATED IN THE X-1 LOOP DURING JULY AND AUGUST 1959. G. M. Allison. Appendix II: PRE-IRRADIATION DATA FOR URANIUM—SILICON SPECIMENS IRRADIATED IN THE X-2-q TEST. L. M. Howe and M. B. Watson. Mar. 1959. (Exp-NRX-1803). Appendix III: FAILURE OF SWAGED UO_2 AND CO-EXTRUDED U_3Si SPECIMENS IRRADIATED IN X-2 LOOP (TEST X-2-q). A. S. Bain, G. M. Allison, L. M. Howe, and A. Ridal. (Exp-NRX-1804). Appendix IV: PRE-IRRADIATION DATA FOR URANIUM—SILICON SPECIMENS IRRADIATED IN THE X-1-n TEST. L. M. Howe and M. B. Watson. Mar. 1959. (Exp-NRX-3302). 81p. (Exp-NRX-3305; AECL-984). AECL.

Uranium—silicon specimens, containing 1.9 wt.% U^{235}, were irradiated in the X-1 and X-2 pressurized water loops in the NRX reactor. Up to burnups in the neighborhood of 600 Mwd/Tonne U, the specimens exhibited small diameter increases. At greater burnups however the swelling of the specimens became appreciable, reaching a maximum volume increase of 7% after a burnup of 1600 Mwd/Tonne. It was postulated that the large increase in volume occurring above 600 Mwd/Tonne was due to the break away of fission-gas bubbles from surface-tension restraint. In addition, after irradiation to 1600 Mwd/Tonne, two of the U_3Si specimens failed; an axial split occurred in one specimen and a circumferential split at the interface between the fuel and end cap occurred in the other. The relatively low activity in the loop after the failure indicated that the corrosion resistance of U_3Si is not affected appreciably by irradiation. (auth)

12042 NOL-CORONA-TM-42-30
Naval Ordnance Lab., Corona, Calif.
RADIATION DAMAGE—SURVEY OF THE FIELD.
Alfred L. Hanzel. May 1959. 13p.

Of the numerous fundamental radiation lattice interactions which can occur, the displacement collision and the replacement collision predominate. Many different radiation environments are presently in existence; however, in terms of electronic components and systems damage none are as difficult to design against as the nuclear detonation. Although all materials are changed by radiation, the most sensitive group, by far, consists of the semiconductor devices. This high sensitivity is attributable to the marked change in carrier concentration and mobility associated with relatively low radiation levels. In terms of total damage, a system can not be expected to be any more resistant than its weakest point. In practice, more durable systems can be obtained by design which incorporates rather than ignores the damage potential of the expected environment. (auth)

12043 NP-8430
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
MONTHLY ACCESSION LIST NO. 32 [ON RADIATION EFFECTS DATA]. Feb. 15, 1960. 24p. Project No. 2133. Contract AF33(616)-6564.

12044 NP-8525
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
MONTHLY ACCESSION LIST 33. [ON RADIATION EFFECTS DATA]. Mar. 15, 1960. 28p. Project No. 2133. Contract AF33(616)-6564.

Abstracts of 87 papers pertaining to radiation effects on electrical and electronic systems, polymeric materials, fuels, lubricants, hydraulic fluids, organic and inorganic chemicals, metals, and alloys are presented. Abstracts on dosimetry, irradiation facilities, and space radiation are included. (C.J.G.)

12045 HW-tr-14
PHOTOSTIMULATION AND COLORING OF FUSED QUARTZ IRRADIATED BY X- OR γ-RAYS. M. Latout. Translated by Liz Appleby from J. chim. phys. 52, 267-71(1955). 16p. JCL.

Fuzed quartz, previously irradiated by x or γ rays, was found to become phosphorescent under the action of visible or ultraviolet radiation. An explanation of this phenomenon of reactivation is given. The initial exciting radiation produced color changes in the quartz which appears streaked with dark lines which at times have the form of eddies. Explanations of this nonhomogeneity in color are presented. (C.J.G.)

12046
SWELLING AND FISSION-GAS AGGLOMERATION IN METAL FUELS. A. T. Churchman (Berkeley Labs., London). Am. Inst. Mining Met., Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. No. 9, 13-19(1959).

Fission gas bubble nucleation and theories of swelling in irradiated metal fuels are considered. The gaseous fission products in uranium precipitate into an array of bubbles typically a few hundred angstroms diameter with about 10^{13} bubbles per cc. The growth of the bubbles is discussed. The conditions for breakaway from surface restraint and possible breakaway mechanisms are discussed. (C.J.G.)

12047
FUNDAMENTALS OF INERT-GAS AGGLOMERATION AND SWELLING IN METALS. R. S. Barnes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Am. Inst. Mining Met., Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. No. 9, 21-4(1959).

Some of the principles governing swelling of metals upon irradiation are discussed. Mechanisms of bubble formation are discussed. The effects of heat treatment after irradiation are described. (C.J.G.)

12048
IRRADIATION BEHAVIOR OF U—Fs AND U—Pu—Fs FAST REACTOR FUELS. J. A. Horak and J. H. Kittel (Argonne National Lab., Lemont, Ill.). Am. Inst. Mining Met., Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. No. 9, 35-8(1959).

The irradiation behavior of U—Pu—Fs (Fs is fissium alloy) fast reactor fuels is discussed. The U—Fs alloys were found to be very stable under irradiation, particularly in the as-cast condition. The U—Fs alloys, containing 3.3 to 10 wt. % Fs, resisted swelling up to 600°C. Irradiation-induced transformation in the alloys from the orthorhombic α-phase to the BCC γ-phase was accompanied by a decrease in density and length changes. The addition of Pu to the U—Fs alloys lowered the swelling temperature to the range 400 to 450°C. (C.J.G.)

12049
CRYSTALLOGRAPHIC STUDY OF RADIATION-INDUCED RECOVERY IN COLD-WORKED URANIUM. D. Tardivon (Centre d'Etudes Nucléaires, Saclay, France). Am. Inst. Mining Met., Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. No. 9, 39-44(1959).

A crystallographic study of radiation-induced recovery in recrystallized and cold-worked uranium is presented. It is shown how to calculate the volume of perturbations of the fission atom. (C.J.G.)

12050
IRRADIATION BEHAVIOR OF UO_2 FUEL ELEMENTS. J. A. L. Robertson, A. S. Bain, G. M. Allison, and W. H. Stevens (Atomic Energy of Canada Ltd., Chalk River, Ont.). Am. Inst. Mining Met., Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. No. 9, 45-70(1959).

The irradiation behavior of sintered and swaged UO_2 and UO_2 fuel rods was studied. Data are tabulated on: UO_2 temperature; sheath deformation; fission-product release from a defected sheath; fission-product-gas accumulation within an intact sheath; swaged element irradiation behavior; and burnup. The data were obtained using a "Hydraulic Rabbit." (C.J.G.)

12051
THE SWELLING OF UO_2 AT HIGH BURNUP. W. K. Barney (General Electric Co., Schenectady, N. Y.). Am. Inst. Mining Met., Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. No. 9, 71-4(1959).

The swelling of enriched UO_2 at 300 to 1500°C and at burnups of 10 to 30 at. % was studied. Burnups in excess of 50 at. % and UO_2 temperatures in excess of 2600°F were achieved. Two types of UO_2 were studied: (1) high-density, high-fired UO_2 particles dispersed in stainless steel and (2) low bulk density, steam-oxidized UO_2 powders in stainless steel. (C.J.G.)

12052

IRRADIATION BEHAVIOR OF ThO_2-UO_2 FUELS. L. A. Neimark and J. H. Kittel (Argonne National Lab., Lemont, Ill.). Am. Inst. Mining Met., Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. No. 9, 83-5(1959).

The irradiation performance of ThO_2-UO_2 fuel is discussed. Fuel elements in which the pellets were lead-bonded to aluminum alloy cladding permitted a higher average heat flux without cladding failures resulting from burnout than did a helium bond. A decreased central void formation was observed when using molybdenum wire reinforcement. (C.J.G.)

12053

EFFECTS OF GAMMA-RAY IRRADIATION ON SELENIUM AND CUPROUS OXIDE RECTIFIERS. Koichi Toyoda, Akira Kawabata, and Tetsuro Tanaka (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 319-20(1959) Dec.

Some radiation effects of intense γ rays from a 1940-c source on cuprous oxide and selenium rectifiers are given. The results show that both forward and reverse currents in selenium were increased, but for cuprous oxide the forward current was decreased and the reverse current was increased. (B.O.G.)

12054

OPTICAL ABSORPTION BANDS IN γ-RAY IRRADIATED LiF CRYSTALS. Kuniya Fukuda (Kyoto Univ.) and Akizo Okuda (Ritsumeikan Univ., Japan). Bull. Inst. Chem. Research, Kyoto Univ. 37, 321-6(1959) Dec.

The color centers produced in LiF crystals by γ-rays from Co^{60} were investigated. The time rate of increase of F-centers diminished with continued γ-ray irradiation and that of M-centers was when F-center concentration was lower than $2 \times 10^{16}/cm^3$. There was a square relationship between the densities of both centers. The band at 220 mμ was developed in some crystals by the exposure to F-band light and not at all in other crystals. (auth)

12055

EFFECTS OF GAMMA-RADIATION ON ALKALI HALIDE CRYSTALS. Kunio Ozawa (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 327-34(1959) Dec.

The radiation effects by γ-rays on the infrared absorption spectra of alkali halide crystals (LiF, KI-Tl, and NaI-Tl) were investigated. In LiF crystal, the 3595 cm^{-1} band caused by FH... F anions has vanished completely at 4.4×10^6 r, but the new absorption bands appeared at 1950 cm^{-1}. In KI-Tl crystal, new absorption bands at 1410, 1370, 888, and 805 cm^{-1} which should not appear in nominally pure KI crystal were observed. The absorption bands at 1370 and 805 cm^{-1} were decreased and a new induced band at 1250 cm^{-1} was enhanced with increasing γ dosage. Similar spectra are obtained for NaI-Tl crystal. The data on the pressure dependence of the dielectric constant of NaCl irradiated with γ-rays are given as a function of hydrostatic pressure from 0 to 5,000 kg/cm^2. (auth)

12056

PHOTOGRAPHIC PROCESS IN THE SILVER-CONTAINING GLASS EXPOSED TO U.V.- AND GAMMA-RADIATION. Megumi Tashiro, Naohiro Soga, and Sumio Sakka (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 341-8(1959) Dec.

To investigate the mechanism of the photographic process in silver-containing glasses, their spectral absorption curves from room temperature to 550°C were measured successively after exposure to uv or γ-radiation. Developments of the absorption bands associated with the latent image and also with the permanent image were confirmed. (auth)

12057

EFFECT OF COBALT-60 GAMMA RADIATION ON ION EXCHANGE RESIN. Tsunenobu Shigematsu and Toshiki Oshio (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 349-52(1959) Dec.

The effect of gamma radiation on commercial ion exchangers was studied. Air dried samples were sealed in polyethylene pouches and exposed to radiation from cobalt-60 (2000 curie, dose rate $2 \cdot 10^5$ r/hr) for a given period ranging from 1 to 177 hrs. The total ion exchange capacity of the samples was determined. Gamma irradiations up to 20 hrs do not prohibitively decrease the capacity of cation exchangers. When exposed for 177 hrs, carboxylic cation exchanger was most resistant to radiation damage. It was proved that phenolic base cation exchanger was more stable than sulfonated styrene-divinyl benzene cation exchanger, anion exchanger lost three times more capacity than cation exchanger with exposure for 177 hr. For strong basic quaternary ammonium anion exchanger, chloride form was somewhat more stable than hydroxyl form. (auth)

12058

EFFECTS OF γ-RAY IRRADIATION ON POLYMERS. I. EFFECTS OF γ-RAY IRRADIATION ON ELONGATED FILAMENTS OF LOW AND HIGH DENSITY POLYETHYLENES. Ichiro Sakurada, Waichiro Tsuji, and Fujiko Kimura (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 353-60(1959) Dec.

The effects of γ irradiation in vacuum and in air on physical properties were studied in high and low density polyethylene filaments elongated to various degrees. The gel fraction of the vacuum-irradiated filaments increased with dose and was independent of the degree of elongation. The low density polyethylene irradiated in air was insoluble at 8.2×10^6 r and 1.5×10^7 r, but at a higher dose it was soluble in xylene of 80°C except for samples of low-degree elongation. The high density polyethylene irradiated in air dissolved in xylene at 120°C for all radiation doses used. Using a theory proposed by Charlesby regarding the relation between solubility and dose, an experimental curve was found to be in an approximate agreement with the theoretical curve of $f = 0.5$. G-values of crosslinking at the gelation point was 4.2 for the low density polyethylene and 4.9 for the high density polyethylene. The density of these filaments increased slightly with dose in vacuum-irradiation, and remarkably in air. (auth)

12059

EFFECTS OF γ-RAY IRRADIATION ON POLYMERS. II. EFFECTS OF γ-RAY IRRADIATION ON MECHANICAL PROPERTIES OF FILAMENTS OF LOW DENSITY POLYETHYLENE. Ichiro Sakurada, Waichiro Tsuji, and Fujiko Kimura (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 361-7(1959) Dec.

Changes in mechanical properties of low density polyethylene filaments elongated to various degrees by γ-ray irradiation were studied. The tensile strength of the irradiated filaments changed slightly with dose up to 10^7 r, but at higher doses it increased with vacuum-irradiation and decreased with air-irradiation. Young's modulus and degree of elasticity of irradiated samples at 65% RH and 20°C hardly changed. The changes of these mechanical properties with irradiation appear to be independent of the degree of elongation. The percent shrinkage of the samples decreased with dose, and their flow point was raised in vacuum-irradiation but lowered in air. (auth)

12060

EFFECTS OF γ-RAY IRRADIATION ON POLYMERS. III. EFFECTS OF γ-RAY ON MECHANICAL PROPERTIES OF FILAMENTS OF HIGH DENSITY POLYETHYLENE. Ichiro Sakurada, Waichiro Tsuji, and Fujiko Kimura (Kyoto Univ.). Bull. Inst. Chem. Research, Kyoto Univ. 37, 368-73(1959) Dec.

For comparison with low density polyethylene, the effects of irradiation on the mechanical properties of high density polyethylene filaments were studied. With the vacuum-irradiation, the tensile strength decreased with dose for the unelongated and slightly elongated samples; it was practically constant for highly elongated samples. On the other hand, the tensile strength of the air-irradiated samples decreased considerably with dose. Young's modulus and degree of elasticity at 65% RH and 20°C were insensitive to dose, just as those of the low density polyethylene. The per-cent shrinkage of the irradiated filaments decreased with dose, and the flow point rose in vacuum irradiation but fell in air-irradiation. (auth)

12061

THE FORTY-SIXTH THOMAS HAWKSLEY LECTURE. EFFECT OF NUCLEAR RADIATION ON ENGINEERING MATERIALS. A. H. Cottrell (Univ. of Cambridge, Eng.). Chartered Mech. Eng. 7, 105-19(1960) Mar.

A lecture is presented on the subject of radiation damage to engineering materials used in reactor designs. Three main types of radiation damage were discussed: electronic, knock-on, and transmutation. In electron damage, the electrons are knocked out of their orbits into higher energy states. In knock-on damage, an atom is displaced in a material by heavy collision from a nuclear particle, and often so violently that it in turn knocks a whole cascade of atoms out of place. In transmutation damage, a neutron enters an atomic nucleus and causes it to transform into a different chemical element. The effects of radiation on graphite, steel, niobium, and copper are cited in the discussion. The most serious practical effects of radiation damage occur in the uranium fuel itself, taking the form of dimensional instability. The theory of radiation growth in uranium is suggested as a possible way of overcoming radiation damage difficulties. (B.O.G.)

12062

ON THE COLORATION IN ALKALI HALIDE CRYSTALS BOMBARDED AT VARIOUS ANGLES BY 6 TO 15 kev ELECTRONS. A. R. Shul'man and E. P. Gel (Kalinin Leningrad Polytechnic Inst.). Fiz. Tverdogo Tela 2, 524-9(1960) Mar. (In Russian)

The coloration in NaCl, KCl, and KBr monocrystals bombarded at various angles by 6 to 15 kev electrons was measured. The depth of coloration represents an approximation of electron penetration and electron scattering. (R.V.J.)

12063

RECOMBINATION CENTERS PRODUCED IN Ge BY FAST NEUTRONS. Nguyen van Dong and Andre Barraud (Centre d'Etudes Nucleaires, Saclay, France). J. Electronics and Control (1) 7, 275-88(1959) Sept. (In French)

Some N and P crystals of Ge were irradiated at ambient temperature by fast neutrons in a nuclear reactor. A study was made of the recombination centers formed as a result of the bombardment, especially for the determination of the locations of the levels of the centers, the electron capture cross sections, and the holes. The experiments were made on variation of the lifetime of minority carriers as a function of integral neutron flux and as a function of temperature after bombardment. A P-N junction was also irradiated and, by the photovoltaic effect, the current variations at short circuit were studied to deduce the variations of lifetime during the bombardment. Finally, some annealing experiments were attempted on some irradiated crystals. A difference in recovery behavior for the N- and P-type crystals was found. (T.R.H.)

12064

BULK DISTRIBUTION OF LATTICE DEFECTS IN GERMANIUM CRYSTALS IRRADIATED WITH FAST ELECTRONS. L. S. Smirnov and P. A. Glazunov (Lebedev Physical Inst., Moscow). Soviet Phys.-Solid State 1, 1262-3(1960) Mar.

The bulk distribution of lattice defects in germanium crystals produced by irradiation with electrons possessing energies of from 500 to 900 kev was measured by the electrical conductivity of the germanium in the direction of incidence of the electron beam. The limit energy of defect formation by the electrons was found to be 380 kev. The nature of the defect distribution curves at different stages of defect formation indicates that defect diffusion is unimportant, and irradiation of germanium by electrons with energies from the limit value up to 900 kev results in the formation of only one type of defect. (auth)

12065

DETERMINATION OF THE NUMBER OF ACCEPTOR LEVELS OF DEFECTS CREATED IN GERMANIUM BY IRRADIATION WITH γ-RAYS. N. A. Vitovskii, T. V. Mashovets, and S. M. Ryvkin (Physicotechnical Inst., Leningrad). Soviet Phys.-Solid State 1, 1266-8(1960) Mar.

A description is presented of a method for determining the total number of acceptor levels belonging to one defect l. For the defects created in germanium by γ-radiation, $l = 4$, assuming that the 0.18-ev level is the uppermost level belonging to the defect. It was shown that the cross section for defect formation is $\sigma \simeq 4.0 \times 10^{-27}$ cm^2. Proposals are presented to investigate the energy spectra of the defects in the forbidden region; and to extend the temperature limits to liquid helium to investigate the regions of the forbidden gap located next to the conducting and valence zones. (B.O.G.)

12066

IMPROVEMENTS IN IRRADIATED OLEFIN POLYMERS. (to Phillips Petroleum Co.). British Patent 831,896. Apr. 6, 1960.

Irradiation treatment of olefin polymers to improve their properties and usefulness is described. In an example, polyethylene blended with carbon black was molded and its physical properties measured. After irradiation in a reactor at 75°F to different dosages the properties were compared to those prior to irradiation. A heat treatment at 290 to 300°F for 20 min resulted in a product with improved elongation behavior, tensile strength, stiffness, and density. (T.R.H.)

PHYSICS

General and Miscellaneous

12067 AECU-4508(Suppl.)

Los Alamos Scientific Lab., N. Mex.

THERMODYNAMIC PROPERTIES OF DETONATION

PRODUCTS. Charles L. Mader. Apr. 1960. 57p. (GMX-2-R-60-1). OTS.

Supplement to GMX-2-R-59-3.

Ideal gas thermodynamic functions are presented for seventeen molecular species. Thermodynamic functions of ten solids are also included. Computation methods are described and references concerning these methods are listed. (J.R.D.)

12068 AERE-M-563

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell. Berks. England.

THE DISTRIBUTION OF CURRENTS ON THE SURFACE OF A TOROIDAL CONDUCTOR. R. J. Tayler. Jan. 1960. 22p. BIS.

Currents. flowing on the surface of an ideally conducting torus, must be distributed in such a way that there is no component of magnetic field normal to the surface of the torus. It is shown how this distribution of currents can be calculated when all the currents flow in the direction of the major circumference of the torus. A toroidal co-ordinate system, having the conducting torus as a co-ordinate surface. is used. Results are given for four values of the torus aspect ratio between 3 and 6. In each case the current density around the inner circumference is much higher than around the outer circumference. When the aspect ratio has the value 3, the current density around the inner circumference is eight times that around the outer circumference. (auth)

12069 AERE-R-3118

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE OPTICAL SPECTRA OF SOME RARE EARTH AND TRANSURANIC ELEMENTS IN THE 1-3 MICRON REGION. PART IV: THE SPECTRUM OF NEPTUNIUM. L. Bovey and E. B. M. Steers. Dec. 1959. 8p. BIS.

A list of wavelengths and intensities for neptunium lines is given together with a short discussion of the experimental technique used in their determination. (J.R.D.)

12070 AFCRC-TN-59-790

Texas. Univ., Austin. Electrical Engineering Research Lab.

ATMOSPHERIC WHISTLERS AND THE ELECTRON DENSITY IN THE IONOSPHERE. Report No. 6-30. F. H. Shammatt. Oct. 21, 1959. 27p. Contract AF19(604)-5504. (AD-229200).

Some of the electromagnetic energy released from lightning strokes travels a path through the ionosphere essentially parallel to the magnetic lines of the earth's magnetic field. It arrives at the ground in the opposite hemisphere as a frequency dispersed wave train with time delay increasing with decreasing frequency. The extent of this dispersion has previously been shown to be a function of the height distribution of electron density in the ionosphere along the path traveled. A method of computing the dispersion from a knowledge of the electron density is presented and observed and computed dispersions based on an assumed exponential electron density height distribution are compared. The correlation between the two sets of curves is sufficiently good to lend credence to the assumed electron distribution. (auth)

12071 AFOSR-TN-59-1082

Brooklyn. Polytechnic Inst.

SIMPLIFIED VIBRATION ANALYSIS OF ELASTIC SANDWICH PLATES. Technical Note No. 5. Yi-Yuan Yu. Aug. 1959. 25p. Contract AF49(638)-453.

A new flexural theory of elastic sandwich plates has been developed, and, on the basis of the theory, the flexural vibration of sandwich plates has been analyzed. The theory is good for a very wide frequency range that is of practical interest, but vibration analysis on the basis of the theory will in general be complicated due to the high order of the equations. For low frequency ranges simplified treatment of the vibration problem becomes possible and is discussed. Simpler equations of motion of sandwich plates are introduced, and their accuracy is determined by comparing with the previous more complete equations. (auth)

12072 AFOSR-TN-59-1163

Brooklyn. Polytechnic Inst.

A NEW THEORY OF SANDWICH PLATES—GENERAL CASE. Technical Note No. 6. Yi-Yuan Yu. Nov. 1959. 28p. Contract AF49(638)-453.

The one-dimensional flexural case of a new theory of elastic sandwich plates was previously developed. The general two-dimensional case of the theory is given. Extension as well as flexure is considered, and the core of the sandwich may be either isotropic or orthotropic. As the one-dimensional case, the general theory is valid for any symmetrically arranged three-layered plate and for vibration analysis involving wide frequency ranges. For sandwiches with very thin faces simplified equations good for limited frequency ranges are deduced. A brief discussion is given on sandwiches with cores composed of Kelvin-Voigt material. (auth)

12073 AFOSR-TN-60-118

California. Univ., Berkeley and Brookhaven National Lab., Upton, N. Y.

X-RAY YIELDS FROM μ-MESONIC ATOMS. M. A. Ruderman. Dec. 1959. 38p. Contract AF49(638)-327.

The interesting suggestion has been made that the rapid drop in the yield of K x rays in the light elements may be associated with the capture of μ-mesons into the metastable 2s-state. The mechanisms for making transitions from the 2s to the 1s state and from various p-states into the 2s state were investigated in detail for Li, Be, and B. It is found that the paradoxical reduction of K x rays remains unexplained. Stark mixing of the mesonic 2s and 2p states by the electric fields of the atomic electrons allows "mixed" Auger-radiative transitions to the 1s state to compete favorably with radiationless transitions. These mixed transitions give a high-energy x ray and a relatively negligible (10 — 50 ev) electronic excitation and so contribute to the observed K_α yield. Even if the "mixed" transitions are ignored, there is no mechanism which gets a large fraction of μ-mesons into the 2s state that at the same time does not violently contradict both theoretical estimates and observed K x ray yields from light π-mesic atoms. (auth)

12074 AFOSR-TR-60-30

Collège de France, Paris. Conservatoire National des Arts et Métiers.

DYNAMICAL THEORY OF THE REFLECTION OF X-RAYS ON CURVED CRYSTALS (SYMMETRICAL BRAGG CASE). Technical (Final) Report. D. Taupin. Jan. 1960. 31p. Contract AF61(052)-51.

A dynamical theory built on the same basis as the Darwin theory is applied to perturbated crystals. It allows for a perturbation being regular and continuous, and depending on one geometrical coordinate; this coordinate is perpendicular to the reflecting planes and to the crystal surfaces, since only the symmetrical Bragg case is considered. It leads to a complex differential equation, which can only be numerically resolved. The case of a perturbation being a linear function of the coordinate is studied and a method is given for the calculation of the reflecting power in the general case when the displacement is a quadratic function of the three space coordinates. Numerical values are given for some reflections on silicon. Experiments are made and compared with theory, in the case of the 400 symmetrical Bragg case, of molybdenum radiation, on silicon for various cylindrical and elastical curvatures. Experimental results are in fair agreement with theoretical calculations and the differences are expected to be due to imperfections in the experimental sample. (auth)

12075 AFOSR-TN-60-106
Rutgers Univ., New Brunswick, N. J.
NUCLEAR MAGNETIC RESONANCE STUDY OF XENON. R. L. Streever, Jr. and H. Y. Carr. Jan. 26, 1960. 29p. Contract AF18(603)-6.

The spin lattice relaxation time T_1 of Xe^{129} was measured as a function of temperature in the liquid and pressure in the gas. A strong shift in the external resonant field at constant frequency but varying density was discovered. For densities greater than 50 amagats (50 times the density at 0°C and atmospheric pressure), this shift is 3.45 milligauss per amagat. The shift between a 48 atm gas sample at room temperature and a liquid sample at −75°C is 1.43 ± .06 gauss. The activation energy of the product of the density and T_1 in the liquid is 0.6 ± 0.1 kilo cal/mole. At room temperature between 48 and 73 atm., T_1 varies as the reciprocal of the density to the exponent 2.1 ± 0.4. The absolute values of the relaxation times found in this study are approximately 6 times longer than previously reported values. At 48 atm the experimental value of T_1 is 2600 ± 600 sec. Experimental values were compared with theory in the two limits, a dense liquid and a rare gas. A discrepancy of between two and three orders of magnitude exists. This indicates that the assumed nuclear dipole-dipole interaction is not the dominant relaxation mechanism. Other possibilities for this mechanism are discussed including its relationship to the observed shift. (auth)

12076 AFOSR-TN-60-135
Illinois. Univ., Urbana. Electrical Engineering Research Lab.
MAGNETODYNAMIC DIPOLAR FERRITE MODES. Technical Note No. 2. William Henry Steier. Jan. 15, 1960. 79p. Project No. 47501. Contract AF18(603)-62.

An experimental and theoretical investigation has been made of the magnetodynamic dipolar modes of a ferrite rod between conducting sheets. Critically coupled mode Q's as high as 1100 have been measured. The derived characteristic equation for these modes includes propagation effects. Contrasted to the magnetostatic modes, the ferrite sample size can therefore be large compared to a wavelength. Modes charts for the (0,1,m), (0,2,m), and (0,3,m) modes have been numerically calculated for Ferramic R-1 and polycrystalline YIG for three values of the ratio l/m. The mode charts have a range of bias fields from 3 to 20 kilooersteds and a range of frequencies from 4 to 50 kmc. Two types of cutoffs for these modes are discussed and formulas for determining when they occur are presented. To facilitate coupling to the modes, diagrams of the $\vec{B}$ and $\vec{E}$ fields for a typical mode are shown. These modes have been experimentally observed at X and K bands in both Ferramic R-1 and YIG. Good agreement is shown between the theory and the experiment in all cases. The coupling structures which enabled the ferrite resonators to be critically matched to the waveguide input are described. Mode Q's were experimentally measured in both bands and their variation with bias field is reported. The advantages which these modes possess over other solved ferrite modes include relatively high Q, ability to critically couple, and sample size is comparable to the wavelength. (auth)

12077 AFOSR-TN-60-150
Rensselaer Polytechnic Inst., Troy, N. Y.
BUCKLING OF A COLUMN WITH RANDOM INITIAL DISPLACEMENTS. William E. Boyce. Feb. 22, 1960. 18p. Contract AF18(600)-1586. (MathRep-32).

Elementary column buckling theory assumes the column is initially straight and leads to an eigenvalue problem for the buckling load. For curved columns the phenomenon of buckling in a sense disappears, inasmuch as non-zero displacements occur for arbitrarily small loads. The relation between the load and the mean transverse displacement of the column when the initial configuration of the column is random in nature is discussed. (auth)

12078 ARF-1150-9
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DESIGN STUDIES ON CESIUM-137 AS A SOURCE FOR HIGH LEVEL GAMMA IRRADIATORS. Quarterly Progress Report No. 3 Covering the Period from December 1, 1959 to March 1, 1960. L. Voyvodic. Mar. 23, 1960. 8p. Contract AT(11-1)-779. OTS.

Experiments were carried out on a Cs^{137} plaque source of 40 × 40 × $\frac{1}{2}$ inches. Measurements were made of dose distributions in water and of photon spectral distributions in paraffin. For 6-inch-thick water slab absorbers, without air gaps, it was found from the preliminary experiments that the depth dose uniformity can be varied over the range 1.10 to 1.40. The absolute dose rates found were in general agreement with design predictions which indicate irradiator efficiencies in the region of 50% and dose rates in the region of 1 Megarad/hour for high-level indicators. (W.D.M.)

12079 CEA-1117
France. Commissariat à l'Énergie Atomique, Paris.
LA TECHNIQUE DES COUCHES MINCES ET SON APPLICATION À LA MICROSCOPIE ÉLECTRONIQUE. (The Thin Layer Technique and Its Application to Electron Microscopy). Gaston Ranc. Oct. 1957. 114p.

Thesis submitted to the Univ. of Caen, France.

The technique of thin layers obtained by evaporation under vacuum, in the thickness range extending from a few monoatomic layers to several hundred angströms, is discussed. The great theoretical and practical interest of these layers has, it is well known, given rise to many investigations from Faraday onwards. The problem is approached particularly from the point of view of their production and their use in electron microscopy. A critical appraisal is made, in the light of present-day knowledge, based on personal experience and on an extensive bibliography collected on the subject. (auth)

12080 CF-59-2-22
Oak Ridge National Lab., Tenn.
ELECTRICAL INSULATION CHARACTERISTICS OF HELIUM GAS AT HIGH PRESSURES AND TEMPERATURES. R. D. Stulting. Feb. 2, 1959. 15p. Contract [W-7405-eng-26]. OTS.

Published information is not available for accurate prediction of the electrical insulating characteristics of helium at high pressures and temperatures. In general, the breakdown voltage increases as the gas pressure is increased and decreases as the gas temperature is increased. The relatively low breakdown voltage of helium accents the importance of additional investigation in this field. (auth)

12081 CRT-886
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
ENERGY LEVELS OF A COMPLETELY ANISOTROPIC OSCILLATOR. T. D. Newton. Jan. 1960. 105p. (AECL-953). AECL.

Tables of energy levels of a completely anisotropic oscillator are given. (W.L.H.)

12082 IMM-NYU-262
New York Univ., New York. Inst. of Mathematical Sciences.
THE BUCKLING OF A THICK CIRCULAR PLATE USING A NON-LINEAR THEORY. Chester B. Sensenig. Dec. 1959. 20p. Contract AF49(638)-161. (AFOSR-TN-60-41).

The stability of equilibrium of an isotropic circular cylinder when compressed along its curved lateral surface was studied by means of a non-linear three-dimensional theory of elasticity. Formulation of the theory is in Lagrange coordinates and matrix notation. A small perturbation with respect to the state of a uniform plane strain was made and the critical pressures needed to induce a buckled state within the basic three-dimensional theory are determined together with the corresponding modes of buckling. The calculations are restricted to buckled modes with symmetry about the axis of the cylinder. The results were the same as those furnished by the classical thin plate theory in the limit case of small thickness of the cylinder. (C.J.G.)

12083 MIT-20-P
Massachusetts Inst. of Tech., Cambridge.
MEASUREMENTS OF THE THERMAL CONDUCTIVITIES OF GASES AT HIGH TEMPERATURES. Robert G. Vines. Sept. 1958. 18p. Project SQUID. Contract Nonr-1858 (25). (AD-205694).

The thermal conductivities of air, Ar, N, CO_2, and steam were measured at elevated temperatures. (W.L.H.)

12084 MLM-882
Mound Lab., Miamisburg, Ohio.
GAMMA ASSAY BY COINCIDENCE COUNTING. L. N. Russell and G. R. Grove. Aug. 7, 1953. Decl. Mar. 7, 1960. 6p. Contract AT-33-1-GEN-53. OTS.

A method of detecting high-energy γ ray-emitting contamination in samples of Ac^{227} is discussed. Experiments using samples of Ac^{227}, Ra^{226}, and Th^{228} in combinations to simulate contaminated samples of Ac^{227} indicate that as low as 0.02% curie contamination of Ac^{227} by either Ra^{226} or Th^{228} can be detected in samples of Ac by coincidence-counting technique. (auth)

12085 NASA-TN-D-261
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
ONE-DIMENSIONAL ANALYSIS OF ION ROCKETS. Harold R. Kaufman. Mar. 1960. 35p. OTS.

A one-dimensional analysis was made of space-charge effects in ion and electron accelerators and the problems associated with mixing beams from such accelerators. The accelerate-decelerate principle was useful for maintaining high beam current densities of both electrons and ions. High electron velocities will tend to be a problem, even with an accelerate-decelerate design. The effect of such excess electron velocity (above ion velocity) on the mixing or neutralization process is determined. (auth)

12086 NP-8416
Duke Univ., Durham, N. C.
DUKE MICROWAVE LABORATORY REPORT NO. 28 [FOR] NOVEMBER 1, 1959–FEBRUARY 1, 1960. 80p. Project No. R-357-10-6. Contract AF18(600)-497.

With this are bound: MILLIMETER AND SUBMILLIMETER WAVES IN PHYSICS. Walter Gordy. DIELECTRIC RELAXATION OF DILUTE SOLUTIONS IN THE MILLIMETER WAVE REGION. Jürgen Schneider. (AFOSR-TN-60-90); DETERMINATION OF THE COLLISION FREQUENCY OF FREE ELECTRONS IN FLAMES BY MICROWAVE ABSORPTION MEASUREMENTS. Fritz W. Hofmann, Hedwig Kohn, and Jürgen Schneider; MEASUREMENTS OF FREE ELECTRONS IN FLAMES. Jürgen Schneider, F. W. Hofmann, and Hedwig Kohn.

Millimeter and Submillimeter Waves in Physics. The detection and measurement of millimeter and submillimeter radiation is discussed along with development of millimeter and submillimeter wave spectroscopy and the measurements which can be made are described. Dielectric Relaxation of Dilute Solutions in the Millimeter Wave Region. The dielectric losses of benzophenone, diphenylether, diphenylamine, chlorobenzene, and aniline were measured at 12.33, 6.19, 3.08, and 2.47 mm. Determination of the Collision Frequency of Free Electrons in Flames by Microwave Absorption Measurements. A study is briefly described of microwave attenuation in an acetylene flame colored with atomized alkali salt solutions. (For preceding period see NP-8242.) (T.R.H.)

12087 NP-8471
Geophysics Corp. of America, Boston.
A FEASIBILITY STUDY ON THE USE OF ARTIFICIAL ELECTRON CLOUDS FOR DETERMINATION OF RECOMBINATION AND ATTACHMENT COEFFICIENTS. Final Technical Report Covering the period May 11, 1959 through January 10, 1960. Frederick F. Marmo, Jerome Pressman, Leonard M. Aschenbrand, Paul J. Nawrocki, Herbert K. Brown, and Murray Zelikoff. 115p. DA Project No. 3-99-06-108. Contract DA36-039 SC-78925.

The various atomic and molecular decay processes affecting electron density which may be studied by means of artificial electron clouds in the upper atmosphere are examined. This includes such processes as attachment, mutual neutralization, recombination, etc. The theoretical and experimental status of the values for the basic processes is assessed. The variations of the processes with altitude is examined and a classification of the upper atmosphere relevant to the behavior of electron clouds is formulated. Various mathematical models for the different regions are set up for both day and nighttime conditions and solutions are given in detail. Then these solutions are compared with actual experimental data in an effort to determine the various loss mechanism coefficients. Where no data are available, parameterization is resorted to. Conclusions are given as to the feasibility of measuring such constants as attachment coefficients, recombination coefficients, etc., by means of this technique. The gaps to be filled-in are indicated. (auth)

12088 NP-8472
American Machine and Foundry Co. Advanced Research Dept., Alexandria, Va.
ION AND ATOMIC BEAMS IN SPACE. First Semi-annual Report [for] June 15, 1959 through December 31, 1959. Robert L. Carroll. Jan. 21, 1960. 54p. Contract DA-36-03 9SC-78961.

The analysis of beam dispersion under the action of space charge and thermal velocity is made. It is concluded that these effects will limit the useful range of the beam to a few thousand miles unless extremely high-energy particles are used. Dispersion caused by field forces is quite small in relation to space charge and thermal dispersion. Deviations and dispersions due to field forces are expressed in the form of equations and sample calculations are made. Equations to allow for deviations due to field forces are developed and applied to specific cases. (auth)

12089 NP-8527
Avco Corp. Avco-Everett Research Lab., Everett, Mass.
MAGNETOHYDRODYNAMIC POWER GENERATION USING NUCLEAR FUEL. Research Report 87. Richard J. Rosa. Mar. 1960. 21p.

A review of the basic theory of magnetohydrodynamic (MHD) power generators is given. The basic electrical properties of gases are reviewed. Over-all performance characteristics of MHD generators are presented as a function of these gas properties. It is pointed out that MHD shows most promise for applications where high power (one megawatt and up) is desired. The description and performance of an experimental MHD generator is given. MHD power plant cycles are discussed. A cycle designed for use with a nuclear reactor is described. The reactor in this case would need the same temperature capability as those now being developed for nuclear rocket propulsion. Some of the possibilities for the future are discussed in which more exotic forms of high temperature reactor combined with an MHD generator may make possible nuclear powered systems. (auth)

12090 NRL-5408
Naval Research Lab., Washington, D. C.
A STUDY OF PHOTONS IN SODIUM IODIDE SCINTILLATION CRYSTALS. Charlotte M. Davisson and L. A. Beach. Sept. 15, 1959. 77p. Project NR 543-000.

Using Monte Carlo methods coded for computation by the Narec digital computer, a study has been made of the interactions within NaI(Tl) crystals of photons incident along the center axis of cylindrical crystals. Incident energies studied were 0.3, 0.5, 0.7, 1.0, 1.2, and 1.5 Mev, and crystal sizes ranged from 1 in. diameter by 1 in. long to 5 in. diameter by 8 in. long. Pair production was included only as an absorption, and the results were not modified by any response function of counting and recording instruments. The results are presented in a way that shows the variation with incident energy, with crystal diameter, and with crystal length of the following: (a) histogram distributions of the energy given to the crystal by the photons, (b) photoefficiencies, (c) photofractions, (d) number of collisions within the crystals, and (e) the geometrical distribution of the emerging, scattered photons. Constants for an empirical equation for photofractions as a function of incident energy and crystal dimensions were obtained from the results and can be used to estimate photofractions for any incident energy and crystal size in the ranges studied. (auth)

12091 NRL-Memo-969
Naval Research Lab., Washington, D. C.
STATUS REPORT ON THERMOELECTRICITY. [Quarterly Review No. 3]. H. E. Stauss. Dec. 1959. 78p.

A review of developments in thermoelectricity in the United States is given. Data on the semiconductor electronic characteristics of CuS, PbTe, ZnSb, and InSb measured in quartz capsules are presented. The thermoelectric characteristics of the alloy $In_{0.4}Ga_{0.6}As$ were compared with InAs and GaAs. Data on the semiconductor characteristics of chalcopyrite and related structures are given. The thermoelectric characteristics of several semiconductor materials are reviewed. (C.J.G.)

12092 OMCC-HEF-195
Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
THE NATURAL ISOTOPIC COMPOSITION OF BORON. W. J. Lehmann. May 28, 1959. 14p. Contract AF33(600)-33920. (AD-228921).

Progress during the past 35 years in research to determine the isotopic composition of boron is reviewed. Chemically determined atomic weights have a relatively large uncertainty, while results obtained from mass spectra of boron trifluoride have been unreliable because of experimental difficulties. On the other hand, abundance ratios obtained from mass spectra of boranes have been highly consistent. It is proposed that a B^{11}/B^{10} ratio of 4.00 (80/20) approaches the true natural abundance ratio much more closely than the presently accepted value of 4.31 (81.17/18.83). This would require revision of the atomic weight of boron from 10.32 to 10.811. (auth)

12093 OSR-TN-60-153
Washington Univ., St. Louis.
A TABLE OF CIRCULARLY POLARISED GAMMA RAY COMPTON SCATTERING CROSS SECTIONS. Technical Report No. 28. D. A. L. Paul. Dec. 1959. 43p. Project No. 37504. Contract AF18(603)-108.

Tables of Compton scattering cross sections are given for gamma rays from 0.25 kev up to 10 Mev, and for all scattering angles by increments of the cosine of 0.05. Both circular polarization dependent and circular polarization independent cross sections are given, and also the ratio of these cross sections. In computing polarization dependent cross sections, the spin orientation of the scattering electron was chosen so as to make the cross section a maximum. The spin orientation required to do this is tabulated. (auth)

12094 SC-2925(TR)
Sandia Corp., Albuquerque, N. Mex.
THE PROBABILITY OF COVERAGE OF POINT OR SPHERICAL TARGETS BY AN EFFECT SPHERE. June 24, 1953. 13p. OTS.

This paper is concerned with a nomograph designed to give the probability P(f) that the fractional part of a given spherical target which is covered by the effect sphere of a successful bomb burst is at least a given fraction f provided the radius of the effect sphere and the spherical probable error of its delivery are known. The probability scale attached to the nomograph chart is to be used when the point of aim is the center of the spherical target; the case of the aiming point distinct from the center of the spherical target is treated with the aid of the accompanying set of probability scales for off-center aiming. A separate chart is given for the probability of coverage of a point target; this probability may also be determined with the aid of the point target reference line of the nomograph chart and the appropriate probability scale. (auth)

12095 TID-5612
Johnston (William H.) Labs., Inc., Baltimore.
BASIC RADIATION STUDIES. Quarterly Progress Report No. 1 for the Period from November 1, 1959 through January 31, 1960. 7p. Contract AT(11-1)-650. OTS.

The experimental work is directed toward the study of multiple ionization processes by means of the coincidence mass spectrometer. The vacuum system was converted from elastomer O-ring gaskets to gold O-ring gaskets in order to minimize deactivation of the electron multipliers by volatile materials from the gaskets. A new transistorized discriminator for very fast pulses was designed, constructed, and tested. Theoretical studies are being carried out into two areas, modification of the statistical theory of mass spectra for low excitation energy and the estimation of the probable importance of multiple ionization in gases. (W.L.H.)

12096 UCRL-5679(p.13-18)
California. Univ., Livermore. Lawrence Radiation Lab.
A NEUTRON POLARIZATION EXPERIMENT. William H. McMaster. 6p.

When a nuclear device is exploded, there is an extremely intense and short burst of both neutrons and gamma rays. It is possible to obtain a pulse of about 10^{24} neutrons with a width at half maximum on the order of a few tens of millimicroseconds which yields a peak intensity of about 10^{32} neutrons per second. A Cockcroft-Walton accelerator would have to operate for 3 million years to produce the same number of neutrons. If appropriate geometries can be arranged, there should be a realm of experiments in which a nuclear device is used as a source. Experiments involving the time-of-flight technique were studied and found to be feasible in the geometries available at the underground test site in Nevada. These include applications of the fission neutron spectrum to study the $(n,n\gamma)$ cross sections by allowing the neutrons to strike targets of different elements and detecting the inelastic gamma rays produced, applications of nuclear device experiments to yield continuous data, and investigations of neutron polarization by a double scattering of neutrons. (C.H.)

12097 UCRL-5679(p.19-23)
Brookhaven National Lab., Upton, N. Y.
HIGH RESOLUTION NEUTRON SPECTROSCOPY WITH NUCLEAR EXPLOSIONS. D. J. Hughes. 5p.

Nuclear explosions are considered as a source for high-resolution neutron spectroscopy. Nuclear time-of-flight measurements are compared with results with both the pulsed source and the fast chopper. It is concluded that the best way of utilizing the tremendous intensities available in nuclear explosions for high-resolution spectroscopy would be to gain a large factor of resolving power, either by greatly extending the flight path or by performing types of experiments that are essentially impossible with conventional sources. (C.H.)

12098 UCRL-5679(p.24-9)
Los Alamos Scientific Lab., N. Mex.
SOME PHYSICS EXPERIMENTS DEPENDENT UPON INTENSE, SHORT DURATION NEUTRON PULSES. Marvin M. Hoffman. 5p.

Procedures are described for obtaining from a thermonuclear device a large flux of neutrons collimated into a beam having a sufficiently small angular divergence to satisfy the requirements of experimental applications. Measurements are discussed which are made as a function of energy. Proposed experiments are described in which scattering angles of from $\sim 10^{-1}$ radians to $\sim 10^{-4}$ radians would be used. Investigations of long-range scattering forces and the force acting between neutrons and electrons are described. The principal advantage of performing the neutron-electron experiment using neutrons from a thermonuclear device appears to lie in the kinematics. One has available a well collimated neutron beam with extremely good energy resolution as a function of time. The neutron flux also appears to be in the range consistent with easily obtained neutron detectors. The measurement of gamma rays from inelastically scattered neutrons is also proposed. It is concluded that numerous experiments may be performed using a thermonuclear neutron source and vacuum transmission system. (C.H.)

12099 UCRL-5679(p.89-95)
Sandia Corp., Albuquerque, N. Mex.
THE USE OF UPPER ATMOSPHERE NUCLEAR EXPLOSIONS AS A RESEARCH TOOL. T. B. Cook. 7p.

Possible studies are outlined in which nuclear explosions are used as excitation sources for the upper atmosphere. Available data are summarized from U. S. tests at high altitudes. (C.H.)

12100 UCRL-5679(p.96-110)
Los Alamos Scientific Lab., N. Mex.
NUCLEAR EXPLOSIONS IN SPACE FOR SCIENTIFIC PURPOSES. Harold Argo, Herman Hoerlin, Conrad Longmire, Albert Petschek, and Andrew Skumanich. 15p.

Possibilities associated with using nuclear explosives as sources of large energy fluxes with known physical characteristics as tools in the exploration of space are reviewed. One of these is the acceleration of a small amount of the outer mass of the device to high velocities by hydrodynamic and radiation pressure and the interaction of such high energy particles with geomagnetic field and the upper atmosphere. The mechanism of the flow of solar energy and the interaction of plasma from one device colliding with that from another might also be studied. Other studies of geophysical phenomena are also suggested. (C.H.)

12101 WADC-TR-57-381
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
TABLES OF INTERPLANAR SPACINGS COMPUTED FOR THE CHARACTERISTIC RADIATIONS OF COPPER, MOLYBDENUM, IRON, CHROMIUM, AND COBALT. [Period Covered] November 1953 to December 1956. H. J. Garrett and R. E. Brocklehurst. June 17, 1957. 729p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: PHYSICAL METHODS OF ANALYSIS OF AIRCRAFT MATERIALS. (AD-142344). OTS.

Computations of interplanar spacings ("d" values) obtained from solutions of the Bragg equation $n\lambda = 2d\sin\theta$ are listed for the radiations normally used in x-ray-diffraction analysis. All angular measurements are expressed as 2θ values. Interplanar spacings are listed for the K_α, K_{α_1}, K_{α_2}, and $K\beta$ radiations of the elements Cu, Mo, Fe, Cr, and Co. (auth)

12102 AEC-tr-4018
NEGATIVE HYDROGEN ION SOURCE. A. V. Almazov and Yu. (Iu.) M. Khirnyy (Khirnyi). Translated by Alfred L. Monks (Oak Ridge National Lab.) from Pribory i Tekh. Ekspt. No. 5, 54-8(1957). 12p. (Includes original, 5p.). OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12 as abstract No. 10702.

12103 CEA-tr-R-799
DÉPLACEMENTS ISOTOPIQUES DANS LE SPECTRE DU THORIUM ^{232}Th et ^{229}Th. (Isotopic Displacement in the Spectra of Th^{232} and Th^{229}). E. A. Vernizh (Vernij) and V. N. Egorov. Translated into French from Optika i Spektroskopiya 6, 262-3(1959). 6p.

The isotopic displacements in the spectrum of thorium were measured on a sample containing the isotopes Th^{229} and Th^{232} in a 1 : 1 ratio. The thorium spectrum was excited in an a-c arc with an intensity of 5 amp. The linear displacement of the first order was 3.4 A/mm. The results of measurements on 76 rays are tabulated. (J.S.R.)

12104
THE ROLE OF THE SPIN-SPIN INTERACTION IN THE MULTIPLET SPLITTING OF THE $^4\Pi$ STATE OF THE

O_2^+ MOLECULE. I. Kovács (Technical Univ., Budapest). Acta Phys. Acad. Sci. Hung. 10, 255-8(1959). (In English)

It is shown that the spin-spin interaction causes just the same deviations from the usual multiplet splitting up of the $^4\Pi_u$ state of the O_2^+ molecule as does the spin-orbit interaction, by which the deviations were originally explained. The experimentally observed deviations originate simultaneously from the two above-mentioned interactions. (auth)

12105

X-RAY FLUORESCENT ANALYSIS WITH A NUCLEAR SOURCE OF PRIMARY RADIATION. K. I. Narbut, R. L. Barinskiĭ, and I. S. Smirnova (Inst. of Mineralogy and Geochemistry of Rare Elements, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 130, 291-4(1960) Jan. 11. (In Russian)

An attempt was made to perform a fluorescence x-ray spectral analysis by replacing the x-ray tube with a prepared Tm^{170} source. The x and γ rays from the source were used for fluorescence excitation in Zn and U. Due to the weak fluorescence intensity, the crystal diffraction method was replaced by a scintillation counter method. The pulse distribution curves of characteristics of K emission from Ge, Ag, Eu, Os, and U were plotted at various stages of excitation. The curves show that the nuclear x-ray generator is more effective for Z = 50 to 63. (R.V.J.)

12106

APPLICATION OF THERMIONIC EMISSION FOR DIRECT TRANSFORMATION OF HEAT INTO ELECTRIC ENERGY. N. D. Morgulis and A. G. Naumovets (Inst. of Physics, Kiev). Fiz. Tverdogo Tela 2, 537-42(1960) Mar. (In Russian)

Direct transformation of heat into electric energy was attempted by applying thermionic emission from cathodes in cesium vapor. The method utilizes the partial compensation of electron volume charge by Cs ions, which appear due to thermal ionization at uncoated areas on the cathode, producing a short-circuit electron current and considerable energy transformation efficiency. The thermal ionization is also used in studies of the adsorption characteristics of coated cathodes with various coatings. (R.V.J.)

12107

INFLUENCE OF ADHESION LEVELS ON THE RELAXATION OF PHOTOCONDUCTIVITY IN THE CdS SINGLE CRYSTALS. L. G. Paritskii and S. M. Ryvkin (Leningrad Inst. of Physics and Tech.). Fiz. Tverdogo Tela 2, 547-57(1960) Mar. (In Russian)

Descriptions are given of an installation for studying the initial stages of CdS monocrystal photoconductivity. The gradient of the initial increase and the effect of a constant exterior light source on the magnitude of the increase are determined. The initial processes are described within the frame of the theory of carrier capture by adhesive levels in monopolar conductivity and adhesive level parameters are calculated. The photocurrent relaxation curves and initial stages of increase developed with a constant exterior light source are plotted. (R.V.J.)

12108

FIELDS IN GAP-EXCITED CIRCULAR DUCTS. J. A. Dattilo (A. C. Spark Plug Div., General Motors, Milwaukee) and J. Van Bladel (Univ. of Wisconsin, Madison). Nuclear Instr. and Methods 6, 283-5(1960) Feb. (In English)

Formulas for the electric and magnetic fields in a circular waveguide, cut in two by a plane perpendicular to the axis, are given with some numerical data. The field is excited by a voltage applied across the two halves of the duct. The energy and momentum kicks which particles experience upon crossing the gap are examined. (auth)

12109

METHODS AND CROSS SECTIONS FOR CALCULATING THE FAST EFFECT. Morton R. Fleishman and Harry Soodak (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 7, 217-27(1960) Mar.

The Spinrad three-group theory of the fast effect is formulated. Techniques are presented for determining the necessary cross sections directly from fundamental data. Three-group cross sections for various materials are tabulated. A comparison is made between the three-group theory and one-group theory with respect to the calculation of R, the ratio of fast-to-thermal fissions, and it is found that the three-group theory appears to give better agreement with experiments. The three-group values of $\epsilon - 1$ are about 20% higher than those calculated from the one-group formula. (auth)

12110

COMPARISON THEOREMS FOR THE ESTIMATION OF AVERAGE COLLISION PROBABILITIES. [PART] II. Lawrence Dresner (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 7, 260-2(1960) Mar.

Three theorems given by Dresner for the estimation of average collision probabilities of convex solids of irregular shape were studied. Proofs are given for two theorems and one is shown to be erroneous. (C.J.G.)

12111

EXPERIMENTAL CHECK OF A MONTE CARLO-CALCULATED DISTRIBUTION OF RESONANCE NEUTRON CAPTURE IN A GOLD ROD. Judson Hardy, Jr., G. G. Smith, and D. Klein (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 7, 263-7(1960) Mar.

A Monte Carlo calculation of the spatial distribution of resonance neutron capture across a 0.387-in. diam gold rod is compared with the corresponding measured distribution, obtained by activating small gold foils stacked across a diameter of a cadmium covered gold rod. The difference between the Monte Carlo calculation and the measurement is attributed to relatively unshielded capture at energies above 250 ev, the starting energy for neutrons in the Monte Carlo calculation. (auth)

12112

A METHOD FOR INTERPOLATION IN MODERATOR TO FUEL RATIO DEPENDENT BUCKLINGS. J. Thie (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 7, 275-6(1960) Mar.

A method is presented for interpolation in moderator to fuel ratio dependent bucklings. It is shown that $XB^2(X)$ is approximately parabolic in X (X is the moderator to fuel ratio) by determining linearity in its derivatives using one group theory. (C.J.G.)

12113

THEORY OF FERROMAGNETIC RESONANCE IN RARE EARTH GARNETS. III. GIANT ANISOTROPY ANOMALIES. C. Kittel (Univ. of California, Berkeley). Phys. Rev. 117, 681-7(1960) Feb. 1.

The giant sharp anisotropy anomalies in YIG discovered by Dillon and attributed to rare earth ions are explained in terms of the crossovers or, most probably, near crossovers of the energy levels of the rare earth ions in the combined crystal and exchange fields. The central consequence deduced by the theory, independent of the detailed behavior of the energy levels, is that $-H_\alpha(\Delta\theta_{1/2})^2 \approx kTN'/M$, where H_α is the anisotropy field; $\Delta\theta_{1/2}$ the angular width of the peak; N' the concentration of rare earth ions at the crossover; M is the total magnetization; the result assumes kT ≫ level splitting at apparent crossover. This and other results appear to be in satisfactory agreement with the available experimental data. Crystals with giant anomalies have useful properties for adiabatic demagnetization experiments—the ferric-rare earth exchange field of 100 k gauss can be effectively turned on or off by rotation of the magnetic moment of the crystal. In an appendix we examine the validity of the molecular field approximation to the ferric-rare earth ion interaction, and we find that the approximation is excellent. A further appendix discusses the question of crossing or noncrossing of energy levels in static fields. (auth)

12114

TIME-DEPENDENT INTERNAL FRICTION IN ALUMINUM AND MAGNESIUM SINGLE CRYSTALS. R. H. Chambers and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 117, 725-31(1960) Feb. 1.

Magnesium and aluminum single crystals subjected to varying amounts of oscillatory strain of audio frequency were investigated by measuring the complex modulus at audio frequencies as a function of temperature and time. If the amplitude of the applied excitation exceeds a critical breakaway strain, an excited mechanical state is shown in a modification of the amplitude dependence of the complex modulus. Upon cessation of the excitation, the excited state decays. The decay following short excitation times obeys a $t^{1/2}$ law, becoming a $t^{1/3}$ law as excitation approaches saturation. The short excitation decay rate is found to be governed by an activation energy in the range of 7 to 10 kcal per mole. The time dependence is considered to be caused by the dispersal and condensation of a pinning atmosphere which has high diffusivity and is easily dispersed by a dislocation segment undergoing pinning interactions with the atmosphere. (auth)

12115

NUCLEAR MAGNETIC RESONANCE OF SOLID HYDROGEN (67—86% ORTHO) AND SOLID DEUTERIUM (33% AND 55% PARA). George W. Smith and Robert M. Housley (Rice Inst., Houston, Tex.). Phys. Rev. 117, 732-5(1960) Feb. 1.

Nuclear magnetic resonance studies on solid hydrogen (H_2) of ortho concentrations from 67 to 86% and of solid deuterium (D_2) with para concentrations of 33 and 55% are reported. The method of Cunningham, Chapin, and Johnston was used to produce the high concentrations ortho H_2 and para D_2. The temperature (T_λ) of appearance of side peaks associated with the removal of rotational degeneracy in H_2 was found to shift to 2.18°K for 86% ortho as compared to a value of 1.6°K for the normal concentration. The T_λ versus concentration data were found to join smoothly to the lower concentration work of Sugawara et al. In addition an interesting hysteresis phenomenon was observed for H_2. It was noted that the temperature of appearance of the side peaks when the H_2 is cooled is some 0.15°K lower than the temperature of their disappearance when the temperature is slowly raised. In the case of deuterium, no peaks were observed for either 33 or 55% para D_2 at temperatures down to 0.9°K. T_1 was measured roughly for the two concentrations. For $n - D_2$, T_1 was found to be 7.6 ± 3 sec. This compares well with the theoretical value of 8 sec given by Moriya and Motizuki. For 55% para-D_2, a value of 3 ± 1 sec was found. The theory of Moriya and Motizuki gives 5 sec. (auth)

12116

ELECTRON-SPIN PARAMAGNETIC RESONANCE STUDIES OF METALLIC LITHIUM IN NEUTRON-IRRADIATED LiF. Y. W. Kim, R. Kaplan, and P. J. Bray (Brown Univ., Providence). Phys. Rev. 117, 740-1(1960) Feb. 1.

The electron-spin paramagnetic resonance absorption of conduction electrons in lithium metal in neutron-irradiated LiF was observed. The dependence of the electron-spin paramagnetic resonance line shape and width on the temperature during irradiation and subsequent thermal annealing is discussed. An upper bound is set on the probability for flip of the spin in a collision with the metal surface. (auth)

12117

$2\ ^{3,1}P$ STATE OF HELIUM ATOM. Gentaro Araki, Koichi Mano, and Masao Ohta (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 469-84(1959) Oct.

The accurate eigenfunctions of $2\ ^3P$ and $2\ ^1P$ states of the He atom are determined by the variation method. The polarization of the s-orbital is taken into account, and the configuration interaction is examined. The non-relativistic energy eigenvalues are $E_{theo}(2^3P) = -2.132\ 612\ 64$ and $E_{theo}(2^1P) = -2.123\ 198\ 66$ atomic units which include both the normal and specific mass correction. These theoretical values are in fairly good agreement with the observed values $E_{obs}(2^3P) = -2.132\ 968\ 6 \pm 7$ and $E_{obs}(2^1P) = -2.123\ 637\ 3 \pm 7$ atomic units. (auth)

12118

THERMIONIC PROPERTIES OF THE METAL OXIDES OF THE III-d AND THE IV-th GROUPS. B. V. Bondarenko and B. M. Tsarev. Radiotekh. i Elektron. 4, 1059-60(1959) June. (In Russian)

Thermionic properties of Sc_2O_3, Y_2O_3, La_2O_3, TiO_2, ZrO_2, and HfO_2 were investigated within a wide range of temperatures. Curves were plotted and compared with tungsten, and the data were developed for constructing Richardson straight lines. (R.V.J.)

12119

FURTHER INVESTIGATIONS ON THE INNER PHOTOELECTRIC EFFECT IN KCl CRYSTALS CONTAINING METALLIC THALIUM CENTERS (KClTl). Józef Rohleder (Inst. of Tech., Wrocław, Poland). Roczniki Chem. 33, 411-18(1959). (In Polish)

From the determination of the sign of the thermoelectric force of KCl(Tl) crystals it was concluded that holes are the free carriers of the photocurrent. The concentration of holes was estimated from their mean range in the electric field. (auth)

12120

A BAND-STRUCTURE MODEL PROPOSED FOR KCl CRYSTALS CONTAINING METALLIC THALLIUM CENTERS (KClTl). Józef Rohleder (Inst. of Tech., Wrocław, Poland). Roczniki Chem. 33, 419-27(1959). (In Polish)

On the basis of the experiments described previously a model of the photoelectric- and absorption-centers is proposed. Using the presented band-structure model for KCl(Tl) crystals. the mechanism of the photoelectric effect and the absorption spectrum are discussed. (auth)

12121

ROTATIONAL TRANSITION IN MOLECULAR COLLISIONS. II. ROTATIONAL TRANSITION IN H_2, D_2 AND HD. Kazuo Takayanagi (Saitama Univ., Urawa, Japan). Sci. Repts. Saitama Univ., Ser. A 3, 87-100(1959). (In English)

The calculation of the effective cross section of the process $H_2\ (l' = 0) + H_2\ (l'') \rightarrow H_2\ (l = 2) + H_2\ (l'')$ was extended to the processes $H_2\ (l' = 1) + H_2\ (l'') \rightarrow H_2\ (l = 3) + H_2\ (l'')$, $H_2\ (l' = 2) + H_2\ (l'') \rightarrow H_2\ (l = 4) + H_2\ (l'')$, and similar processes in deuterium gas. The l parameters are the angular momentum quantum numbers of the molecular rotation. The distorted wave method with the modified wave number approximation was used. Rotational transition in HD gas was studied. It was found that the transition probability is much larger in this gas than in H_2 or in D_2, and the distorted wave method became invalid at temperatures higher than 200°K. (auth)

12122

RESULTS OF LOW TEMPERATURE RESEARCH. XXVII. COMPARISON OF THE ATOMIC AND FUSION HEATS AND THE ENTROPY OF THE CONDENSED ISOTOPES Ne^{20} AND Ne^{22}. K. Clusius, P. Flubacher, U. Piesbergen, K. Schleich, and A. Sperandio (Universität, Zurich). Z. Naturforsch. 15a, 1-9(1960) Jan. (In German)

From 350 liters of technical neon, the pure isotopes Ne^{20} and Ne^{22} were obtained in a separation tube apparatus. The atomic heat in the solid and liquid state, the fusion temperature, fusion heat, triple point pressure, and the entropy difference were measured. A way is given to derive the expansion and compressibility of solid neon so that the C_p values observed could be translated into C_v. The effect of the zero point energy is quite noticeable. The temperature pattern, resulting from the Debye theory, for the difference of the atomic heat and the entropy component of the isotope condensate is also reported. These functions pass through a maximum. In nitrogen and neon a qualitative confirmation of the theoretically postulated behavior is found. Results are tabulated. (tr-auth)

12123

INFLUENCE OF THE DEPOSITION OF RADIOACTIVE SUBSTANCES ON AEROSOLS ON THE EMISSION EFFECT IN MEASUREMENTS OF THE ELECTRICAL CONDUCTIVITY OF AIR. Gerhart Vogler (Universität, Leipzig). Z. Naturforsch. 15a, 89(1960) Jan. (In German)

The measurement of the electrical conductivity of air and gases with radioactive constituents is modified by an emission effect. The magnitude of the emission effect is a function of the mass of radioactive substances in the gas, the effective surface of the measuring condenser, and its exposure time. It was postulated that the addition of radioactive substances decreases the emission effect since by charge neutralization or mass increase and the resulting decrease of the mobility of radioactive coagulates, the amount of radioactive substance deposited on the electrode is decreased. An investigation confirmed this hypothesis. The relationship between nuclear volume, total conductivity, and conductivity quotient is diagrammed. (J.S.R.)

12124

ON SUPERFLUIDITY OF LIQUID He^3. L. P. Pitaevskii (Inst. of Earth's Magnetism, Ionosphere, and Propagation of Radio Waves, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1794-1807(1959) Dec. (In Russian)

A strict investigation is made of the interaction between elementary excitations in a Fermi fluid for large values of the angular momentum relative to the excitation motion. It is shown that this interaction is of the nature of an attractive force so that the suggestion that He^3 is superfluid seems to be justified. Expressions in terms of observable quantities are derived for the asymptotic values of the excitation scattering amplitudes for large values of l. A formula is deduced for the effective mass of an excitation in a Fermi fluid by quantum field theory methods. (auth)

12125

FIBROUS MINERAL AS FISSION PRODUCT SOURCE INCREASES EFFICIENCY OF RECOIL ENERGY OF FISSION PRODUCTS. (to Rensselaer Polytechnic Inst.). German Patent DAS 1 057 701. May 21, 1959. Atompraxis 6, 70 (1960). (In German)

In neutron irradiation of fissionable materials the energy contained in the fission products is used to accelerate the fission products out of the solid matter. For example, when finely divided uranium oxide powder, highly enriched with U^{235}, is exposed to neutrons, about 90% of the fission products are absorbed by the powder and only 10% are expelled from the surface of the powder particles. It was found that the efficiency of the utilization of the recoil energy of the fission products can be increased to more than 60% if a fibrous material is used as a fission product source. The fibrous material must contain as an essential ingredient an isotope or oxide suitable for transformation into a fissionable material. It was proposed that the fibrous material consist of a fiber glass containing Th^{232}, U^{238}, or one of their oxides.

Astrophysics and Cosmology

12126

SUNFLARE II—ROCKET OBSERVATIONS OF SOLAR ACTIVITY. Trans. Am. Geophys. Union 41, 95-104 (1960) Mar.

Conclusions are presented which were drawn from information obtained from rocket observations of solar activity, conducted from Point Arguello on the Pacific Missile Range from July 14 to September 1, 1959, and designated as "Sunflare II." Of the 12 rockets launched 8 were successful, reaching heights of 130 to 150 miles. In the best flights, data were telemetered continuously for nearly eight minutes. Three were launched during flares and five were launched while the sun was quiet or only moderately active. (B.O.G.)

Cosmic Radiation

12127 AFOSR-TN-60-151

Stanford Univ., Calif. Radioscience Lab.

A NEW MECHANISM FOR ACCELERATING ELECTRONS IN THE OUTER IONOSPHERE. Technical Report No. 4. R. A. Helliwell and T. F. Bell. Feb. 23, 1960. 10p. Contract AF18(603)-126.

It is proposed to study the phenomena of high energy trapped particles in the earth's outer ionosphere using a new device for particle acceleration, the "geocyclotron." Through this device trapped electrons in the outer ionosphere can be accelerated to high energy utilizing circularly polarized radiation, traveling in the whistler-mode, and the inherent phase stability of the particle-wave interaction. It is shown that this interaction is roughly analogous to the well-known synchrotron interaction. Implications of the theory are discussed and experiments are suggested which might lead to important new information concerning the behavior of particles trapped in the earth's magnetic field. (auth)

12128 INSJ-24

Tokyo Univ. Inst. for Nuclear Study.

THE MONTE CARLO CALCULATION OF CASCADE SHOWERS. Atsuko Adachi, Yoichi Fujimoto, Tomoko Hasebe, Shun-ichi Hasegawa, Eiichi Goto, Koichi Kamata, and Fumi Nunokawa. Feb. 10, 1960. 20p.

A Monte Carlo calculation is made on the one-dimensional development of cascade showers by the electronic digital computer PC1 of Tokyo University. Using the data of four hundred constructed showers, a statistical analysis is made on the distribution of the track length of photons and electrons in a shower. The root mean square deviation, ΔT_e, for the electron track length, T_e, is found to be $\Delta T_e \sim 0.4\sqrt{T_e}$, while that of the photon track length, T_γ, is about $\Delta T_\gamma \sim 1.8\sqrt{T_\gamma}$. The physical meaning of this result is discussed briefly. An application of the Monte Carlo calculation to experiments on cosmic rays is described. (auth)

12129 NP-8528
New York Univ., New York. Coll. of Engineering.
HIGH ALTITUDE NEUTRON INTENSITY DIURNAL VARIATION. Robert C. Haymes. Mar. 15, 1959. 83p. Project 2.18. Contract N-onr-285(21).

Two balloon flights in which boron-trifluoride neutron counters were carried aloft were launched during September, 1958. The flights attained altitudes of 86,000 and 79,000 feet, at a conventional geomagnetic latitude of 41°N. The data obtained reveal that the neutron intensities in the atmosphere decreased by about 12% since the time of minimum solar activity in 1954, and that this decrease was mainly in the low-energy end of the spectrum, as the mean free path for absorption had increased from 180 ± 25 to 240 ± 30 gm/cm^2. After achieving altitude, the balloons floated at a constant elevation through sunset. A sharp peak in the intensity which occurs just before sunset at balloon altitudes was detected on both flights, and appears to be genuine as it is considerably beyond the statistical errors. Several possible explanations for this effect are discussed. (auth)

12130 JPRS-3123
THE NATURE OF CORPUSCULAR RADIATION IN THE UPPER ATMOSPHERE. I. S. Shklovskii (Shklovskiy), V. I. Krasovskii (Krasovskiy), and Yu. I. Gal'perin. Translated from Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz., 1799-1805 (1959). 12p. OTS.

From an analysis of the space distribution of "earth corona" belts, a number of conclusions concerning the mechanism of generation and "leakage" of hard particles (corpuscles) were drawn. It was shown that the concentration of particles in the solar corpuscular stream is sufficiently high to effect a renewal of particles in the external belt during a period of approximately several hours. The energy distribution of protons and the velocity of generation of hard particles in the internal belt were calculated on the basis of the decay mechanism of neutrons formed in stars, taking into account the moderation of these neutrons during their diffusion through the atmosphere. It was shown that the recording of hard charged corpuscular components of nuclear explosions clearly distorts, for a certain period of time, measurements of the intensity of corpuscular radiation in the "earth corona," particularly in the high-energy region. (auth)

12131 TG-230-T-127
STUDY OF TERRESTRIAL CORPUSCULAR RADIATION AND COSMIC RAYS DURING THE FLIGHT OF THE COSMIC ROCKET. S. N. Vernov, A. E. Chudakov, P. V. Vakulov, and Yu. (Iu.) I. Logachev. Translated from Doklady Akad. Nauk S.S.S.R. 125, 304-7(1959). 10p. (PB-5921045). OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 12813.

12132
RADIATION MEASUREMENT DURING THE FLIGHT OF THE SECOND SPACE ROCKET. S. N. Vernov, A. E. Chudakov, P. V. Vakulov, Yu. I. Logachev, and A. G. Nikolaev. Doklady Akad. Nauk S.S.S.R. 130, 517-20 (1960) Jan. 21. (In Russian)

The specifications of the six gas discharge counters and scintillation counters used for recording cosmic radiation between the earth and moon are described. Data taken by the second Soviet rocket Sept. 12, 1959, at a distance of 9000 to 120,000 km from the earth's center and in the pre-moon region, starting at 40,000 km from the moon's surface, are presented. (R.V.J.)

12133
ROCKET OBSERVATIONS OF HIGH ELECTRON-DENSITY GRADIENTS IN THE IONOSPHERE. J. C. Seddon (U. S. Naval Research Lab., Washington, D. C.). Trans. Am. Geophys. Union 41, 113-18(1960) Mar.

Rocket observations were made of the ionosphere at White Sands, N. Mex., and Fort Churchill, Canada. High electron-density gradients were found in all ionospheric regions penetrated. In the D-region (below 90 km) a high gradient was almost always present near the top of the mesosphere. In the E-region (90 to 170 km) high gradients were associated with sporadic-E at various levels, and in the F-region (above 170 km) they appeared related to the distribution of spread-F. The experimental techniques and further explanations of the observations in the D-, E-, and F-regions are presented. (B.O.G.)

12134
ANGULAR DISTRIBUTION OF SHOWER PARTICLES IN EXPLOSIVE SHOWERS PRODUCED BY HIGH ENERGY COSMIC RAY PARTICLES. A. P. Mishakova and B. A. Nikolskii. Zhur. Eksptl'. i Teoret. Fiz. 37, 1594-1603 (1959) Dec.

The angular distribution of shower particles in showers with an energy of 10^{10} to 10^{13} ev was investigated in the c.m.s. Experimental and calculated results are presented for the dependence of the number of shower particle pairs on the angle between them. It is concluded that a collision of the primary particle and nucleus leads to a symmetric angular distribution of the shower particles in the c.m.s. and that there is no correlation between the angles of shower particle pairs. (auth)

Criticality Studies

12135
THE START-UP OF "MARIUS." G. Alessandri. Bull. inform. sci. et tech. (Paris) No. 36, 27-9(1960) Jan. (In French)

To make a detailed study of the neutron properties of a graphite—uranium lattice, the critical assembly Marius was planned and constructed. The characteristics of the assembly are briefly described. (J.S.R.)

Elementary Particles

12136 AERE-R-3228
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A PROGRAM FOR THE CALCULATION OF THE DÖPPLER BROADENED RESONANCE ABSORPTION OF NEUTRONS WHICH ARE SCATTERED IN THICK TARGETS. (Mercury Autocode Program No. 17: Scattering Integrals). I. C. Pyle. Jan. 1960. 20p. BIS.

A program for the calculation of correction factors to be used in the analysis of neutron scattering experiments to compensate for the finite thickness of the targets (neutron absorption) is described. (C.J.G.)

12137 AFOSR-TN-60-278
Cambridge Univ., England.
SINGLE PARTICLE SINGULARITIES IN SCATTERING AND PRODUCTION AMPLITUDES. Technical Scientific Note No. 5. J. Gunson and J. G. Taylor. Jan. 1960. 19p. Contract AF61(052)-233.

A proof of analyticity properties in momentum transfer of the amplitude for certain physical processes is given. The use of extrapolation in the scattering angle to obtain the pion-nucleon coupling constant from photo-production data is justified, for photon laboratory energies up to 1 Bev. This extrapolation procedure to obtain strange particle parities and coupling constants is also justified for certain strange particle production and scattering processes. (auth)

12138 JEN-55
Spain. Junta de Energia Nuclear, Madrid.
DETERMINACION DE LA LONGITUD DE DIFUSION DE LOS NEUTRONES TERMICOS EN GRAFITO. (Determination of the Diffusion Length of Thermal Neutrons in Graphite). José Garcia Fité. 1959. 82p.

The diffusion length of thermal neutrons in graphite using the least possible quantity of material has been determined. The procedure used was the measurement in a graphite pile which has a point source of fast neutrons inside surrounded by a reflector medium (paraffin or water). The measurement was done introducing an aluminum plate between both materials and then by introducing a cadmium plate between both materials. The difference corresponds to a neutron distribution which would be obtained if on the separation surface of both medium a distributed superficial source of thermal neutrons would exist. (auth)

12139 NP-8393
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.
ELECTRON AND MUON NEUTRINOS. B. Pontecorvo. 1959. 10p. (P-376)

The possibility is considered of solving new problems of neutrino physics by investigating some effects induced by free neutrinos which have not been discussed previously. Attention is drawn to the question of whether the neutrinos emitted in muon decay and the neutrinos emitted in beta decay are identical particles. (W.D.M.)

12140 NP-8394
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.
INTERNAL CONVERSION PAIRS IN NEUTRAL PION DECAY. Yu. A. Budagov, S. Victor (Wiktor), V. P. Dzhelepov, P. F. Ermolov (Yermolov), and V. I. Moskalev. 1959. 14p. (P-403).

Presented at the VI Session of the Scientific Council of the Joint Inst. for Nuclear Research, May 1959 and at the Conference on High Energy Physics held in Kiev, July 1959.

Twenty-seven events of charge-exchange scattering with subsequent decay $\pi^0 \to e^- + e^+ + \gamma$ were recorded in the hydrogen-filled diffusion cloud chamber placed in a magnetic field and exposed to 128 and 162 Mev negative pion beams. A probability of this decay with respect to the usual decay was found. The results of the measurements of momenta and angles of electron-positron pairs are presented. The energy characteristics of pairs and angular distributions experimentally found are in good agreement with the theoretical ones. (auth)

12141 NP-8395
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.
ON AN EXPERIMENTAL METHOD OF DETECTING THE FORM FACTOR IN UNIVERSAL FERMI WEAK INTERACTION THEORY. Ho Tso-hsiu. 1959. 5p. (P-418).

The form factor is usually expressed as a term of "weak magnetism" and a term of pseudoscalar coupling added to the usual V-A Fermi weak interaction theory. An experimental method is proposed for determining the form factor which involves muon capture into a singlet state. (W.D.M.)

12142 NP-8404
Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H. Institut fur Neutronenphysik und Reaktortechnik, Karlsruhe, Germany.
BERECHNUNG DES THERMISCHEN NEUTRONENFLUSSES IN EINER ZYLINDERSYMMETRISCHEN WIGNER-SEITZ-ZELLE NACH DER P_N- UND S_N-METHODE. (Calculation of the Thermal Neutron Flux in a Cylindrically Symmetrical Wigner-Seitz Cell by the P_N and S_N Methods). Report No. 15. H. Küsters. Oct. 19, 1959. 54p.

The solution of the monoenergetic transport equation by development of the neutron distribution function is described by spherical functions (P_N method). The representation of the approximation method for the solution of the transport equation by numerical integration (S_N method) is then given. A comparison is made of the approximation solutions obtained by both methods. The dependence of the thermal utilization factor f on the approximation is shown. The effect of thick aluminum foils (can and guide tubes) of several millimeter thickness on the neutron flux and the f factor is investigated. (tr-auth)

12143 NP-8463
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy.
PROTON—PROTON ELASTIC SCATTERING ANALYSIS AT 8.5 BEV. B. A. Shahbazyan. 1959. 8p. (D-450).

A phase shift analysis of elastic p—p scattering at 8.5 Bev for $l_{max} = 15$ was made. (W.D.M.)

12144 NP-8466
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy and Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.
ON THE MINIMUM NUMBER OF PARTIAL WAVES IN TWO BODY COLLISIONS. V. G. Grishin and V. I. Ogievetskii (Ogievetski). 1959. 8p. (D-453).

A great number of partial waves participate in the interaction between two particles at high energies and it is practically impossible to make a complete phase shift analysis. It is shown that the minimum number of partial waves involved in the interaction is determined if the total elastic cross section and the differential cross section at a given angle are known. (W.D.M.)

12145 NP-8489
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.
ON THE RADIATION CORRECTIONS IN THE WEAK INTERACTION PROCESSES. Ya. Smorodinskii (Ja. Smorodinsky) and Tzo-hsiu Ho. 1960. 4p. (E-458)

Consideration is given to radiative corrections to μ-meson decay. It is pointed out that radiative corrections can be calculated only for processes in which other particles do not take part with the exception of electrons, μ mesons, neutrinos, and γ quanta. (T.R.H.)

12146 NP-8490
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy.
ANTIPROTON PRODUCTION IN NEGATIVE PION INTERACTION WITH NUCLEONS. Kan-chang Wang, Tzu-tzen Wang, Da-tzao Ding, V. G. Ivanov, E. N. Kladnitzkaya, A. A. Kuznetzov, Dinh-Tu Nguen, A. V. Nikitin, S. Z. Otwinowski, and M. I. Soloviev. 1959. 5p. (D-454).

Two events of antiproton production by negative pions on nucleons are described. The experiments were done at the JINR synchrophasotron with a propane bubble chamber in a constant 13,700 gauss field. A cross section estimate for 7 to 8 Bev/c pions is 10^{-30} cm^2/nucleon. (T.R.H.)

12147 UCRL-5679(p.30-43)
California. Univ., [Livermore]. Lawrence Radiation Lab.
THE INTERACTION OF MICROWAVE RADIATION WITH IONIZED AIR. L. F. Wouters, E. A. Boyrie, A. Hyne, and H. McDonald. 14p.

Research studies on the interaction of microwave radiation with ionized air are discussed. Topics discussed include the history of electrons ionized in a dense gas by a flux of high-energy electrons, the effects of impressing an electromagnetic field on ionized gas, the totality of ionized electrons transported by the field against the resistance of molecular collisions, factors affecting rf conductivity, the effect of second-order interactions, the microscopic and macroscopic viewpoints, transport conductivity, propagation, and ionization sources. A microwave transmission experiment is described which was performed in free air, using a pulsed gamma-ray source radiating in the Mev range, and having the exponential time-dependent characteristic e^{nt}. The gamma source strength was independently monitored as a function of time by means of scintillation detectors and the information recorded using oscilloscopes operated in time synchronism with the attenuation experiment. Results confirm a prediction of ionization interaction phenomena in dense gases and bring clarification to a number of conjectures concerning the feasibility of using radio frequency techniques in ionized atmospheric regions. (C.H.)

12148
INTERACTION BETWEEN ELECTRONS AND COHERENT FIELDS. B. Fogarassy (Central Research Inst. of Physics, Budapest). Acta Phys. Acad. Sci. Hung. 10, 305-25(1959). (In English)

Interactions between free electrons and coherent fields, electromagnetic fields having a definite phase, are studied. The expectation value and mean square deviation of electron velocity are determined. Calculations are performed by quantum mechanical as well as classical methods and it is shown that the two methods do not lead to different results. The behavior of a coherent field in respect to free electrons is the same as that of a classical field, apart from the zero point fluctuation. (auth)

12149
THE PROBLEM OF ELEMENTARY CHARGE AND MESON MASS. Th. Neugebauer (Roland Eötvös Universität, Budapest). Acta Phys. Acad. Sci. Hung. 10, 327-36(1959). (In English)

Using a charged-sphere model which has excluded electrons and varying the elementary charge value, it is shown that the actually observed value of this energetic natural constant is very convenient. This fact can be interpreted in one certain respect as the first indication of an elementary charge theory. It is further shown that the charged particle requires even less "space" the larger its mass is, which with reference to the mass produces an electron gas theory of meson decay. If one makes the electron gas charge-compensating and expand the space infinitely, then a completely schematized metal model is obtained. Conversely, if one produces a nuclear fluid model from a partially charge-compensated proton gas, and consideration of the new measurements of Hofstadter leads to this result, then one comes out largely without the assumption of a special (and unknown) nuclear force. (tr-auth)

12150
THE PION-NUCLEON INTERACTION AND DISPERSION RELATIONS. Geoffrey F. Chew (Univ. of California, Berkeley). Ann. Rev. Nuclear Sci. 9, 29-60(1959).

The problem of strong coupling is reviewed as it pertains to the properties of pions and nucleons. Justifications and derivations of the pion—nucleon dispersion relations are discussed. The scattering amplitudes for processes with two ingoing and two outgoing particles are described. The presence of poles in scattering amplitudes is discussed relative to location of the poles, residues, and coupling constants, and extrapolation to the neighborhood of a pole. The use of dispersion relations at a fixed momentum transfer is discussed. The Mandelstam representation of strong coupling is analyzed. (C.J.G.)

12151
STRANGE PARTICLES: DECAYS. L. Okun (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). Ann. Rev. Nuclear Sci. 9, 61-98(1959).

The theory of weak interactions of elementary particles is reviewed relative to the hypotheses of the universal Fermi V—A interaction between particles and the composite model of strangely interacting particles. Emphasis is placed on leptonic decays of strange particles. The properties of weak interactions are discussed. The nature of the weak interaction in muon decay is discussed. The strange particle decays arising from the two cases of lepton interactions with strongly interacting particles involving no change in the strangeness of the latter are discussed. The non-leptonic decays of strange particles are considered. (C.J.G.)

12152
THE EXPERIMENTAL CLARIFICATION OF THE LAWS OF β-RADIOACTIVITY. E. J. Konopinski (Indiana Univ., Bloomington). Ann. Rev. Nuclear Sci. 9, 99-158(1959).

A review of the basic Lee-Yang hypothesis and Fermi's theory regarding β radioactivity is given. Experiments which were performed to clarify the above hypothesis and theory are described. The experiments confirming the existence of the neutrino are discussed. The differences between neutrinos and antineutrinos are discussed in terms of lepton conservation and the two-component theory. The pion and muon decay processes are reviewed. The pionic effects in Fermi interactions are discussed. (C.J.G.)

12153
CLUSTER DEVELOPMENT OF THE DENSITY MATRICES IN THE JASTROW METHOD FOR MANY-FERMION SYSTEMS. S. O. Lundqvist (Univ. of Uppsala). Arkiv Fysik 16, 321-8(1960). (In English)

A method is given for the cluster development of the reduced density matrices for Jastrow wave functions. The method makes extensive use of the properties of the Dirac density matrices corresponding to the uncorrelated motion, in conjunction with the method of expanding the distribution functions for a classical imperfect gas given by Mayer and Montroll. (auth)

12154
ON THE TWO-PHONON SCATTERING OF X-RAYS IN

ALUMINUM. Nanny Nilsson-Fröman. Arkiv Fysik 16, 329-35(1960). (In English)

The contribution from the two-phonon processes to the intensity of diffuse x-ray scattering in crystals was accurately calculated in aluminum for three different directions of the scattering vector $\varkappa = k - k_0$, where k_0 is the wave vector of the incident photon and k that of the scattered photon. The calculation was based directly on the dynamical equations for the lattice vibrations in the harmonic approximation. The only further approximation introduced was the assumption that the temperature is so high that the mean energy of every lattice vibration may be put equal to kT. Comparisons were made between this accurate calculation and different approximate calculations. (auth)

12155

THE DOSE FIELD OF A LINE SOURCE. V. S. Grammatikati, U. Ya. Margulis, and V. G. Krushchev. Atomnaya Energ. 8, 154-5(1960) Feb. (In Russian)

An approximate but sufficiently accurate method is proposed for calculating the dosage distribution from a rod source. The field from a Co^{60} source, with water as an absorption medium, was calculated considering the narrow-beam attenuation factor in water as $\mu = 0.063$ cm^{-1}, $\alpha = -0.095$; $\alpha_2 = 0.060$; $A_1 = 8.88$, $A_2 = 1 - A$, $= -7.88$. The linear source dosage in water is plotted. (R.V.J.)

12156

EFFECT OF STRANGE PARTICLES ON THE S WAVE IN THE SCATTERING OF PIONS. Giuliano Patergnani. Atti ist. veneto sci. lettere ed arti, Classe sci. mat. e nat. 117, 187-90(1958-1959). (In Italian)

A qualitative evaluation is made of the effects on the scattering of pions by nucleons in an intermediate state in which strange particles are present. Previous studies have been based on the hypothesis of parity doubling, but the present study does not require this postulate. The numerical results obtained are tabulated and indicate that the effects caused by strange particles in the intermediate state act to reduce considerably the S wave in N-π scattering. (J.S.R.)

12157

THEORY OF THE SCATTERING OF K MESONS BY NUCLEONS USING THE RELATIVISTIC METHOD OF TAMM AND DANKOFF. Carlo Ceolin and Luigi Taffara. Atti ist. veneto sci. lettere ed arti, Classe sci. mat. e nat. 117, 351-5(1958-1959). (In Italian)

Recent experiments on the scattering of K mesons on nucleons seem to indicate that the K-p interaction potential is repulsive. Theoretical work has shown that a K-Y-N coupling of the scalar type leads to a repulsive potential in disagreement with experiment. Before renouncing direct K-Y-N interaction for possible and simpler schemes to interpret the phenomenon of scattering of K mesons, an investigation was made to see what results are obtained with a pseudoscalar coupling. The calculation of the phase and cross section of the K scattering was made with the Tamm-Dankoff method. The results are in qualitative agreement with experiment which favors the pseudoscalarity of the K-Y-N coupling. (J.S.R.)

12158

ELECTRON TEMPERATURE OF THE MEDIUM IN SYNCHROTRON RADIATION. G. A. Gurzadyan (Byurakan Astrophysical Observatory, Academy of Sciences, Armenian SSR). Doklady Akad. Nauk S.S.S.R. 130, 287-9 (1960) Jan. 11. (In Russian)

Electron temperatures in a medium were determined considering that free electrons are produced by hydrogen atom photoionization induced by synchrotron radiation, that electrons lose their energy by means of hydrogen recombination processes, and that Maxwell distribution of velocities is established between the electrons. Two conditions are accepted as starting points of the problem; the steady state where the number of atoms entering per unit of time into the continuum during photoionization should equal the number of atoms leaving the continuum; and the radiation equilibrium where the energy used in hydrogen atom photoionizations should equal the energy emitted in recombination. The calculations showed $T_e = 110{,}000°$ with $\gamma = 3$ and $T_e = 100{,}000°$ with $\gamma = 5$. (R.V.J.)

12159

ON THE PARAMAGNETIC INELASTIC SCATTERING OF NEUTRONS DUE TO IONS IN THE ANISOTROPIC CRYSTALLINE FIELD. Yasusada Yamada (Osaka Univ.). J. Phys. Soc. Japan 15, 429-35(1960) Mar.

The paramagnetic inelastic scattering of neutrons due to ions of 3d transition elements in the anisotropic crystalline field was considered. When the orbital momentum of the paramagnetic ions is not quenched, the spin states are no longer degenerate but split into discrete levels. The transition between these levels can occur by magnetic dipole interaction of ions with neutrons. In the special case of $FeCl_2$, an antiferromagnetic crystal whose Néel temperature is 24°K, the calculation of the forward scattering cross-sections of neutrons at various temperatures and wave lengths was carried out which showed that it is possible, under ordinary conditions, to observe the inelastically scattered neutrons and hence to obtain information about the energy level scheme of the atomic spin in the crystal. (auth)

12160

DIFFUSE SCATTERING OF X-RAYS BY GAMMA-RAY IRRADIATED ROCHELLE SALT. Koichi Toyoda, Akira Shimada, and Tetsuro Tanaka (Kyoto Univ.). J. Phys. Soc. Japan 15, 536-7(1960) Mar.

Rochelle salt crystals were examined with x rays both before and after a wide range of gamma irradiations. No remarkable change in the diffraction patterns was observed at $\sim 10^5$ roentgens. The intensity of diffuse spots in the Laue photographs increases with dosage. With still further increase of dosage, the Laue spots split and the intensity of diffuse spots is less marked. In the stage where spot splitting has not yet taken place, diffuse spots associated with Laue spots were found to have neither streaks nor fine structures. (D.L.C.)

12161

A POSSIBLE EXPERIMENTAL METHOD FOR THE PRODUCTION AND DETECTION OF HEAVY HYPERFRAGMENTS. R. Levi Setti and W. E. Slater (Univ. of Chicago). Nuovo cimento (10) 14, 895-7(1959) Nov. (In English)

A method is presented for the production and detection of heavy hyperfragments. A uranium-loaded Ilford G-5 stack was exposed to an enriched beam of K^- moderated so as to stop in the stack. An illustration is given for K^- capture by a U^{238} nucleus. From this are formed two fission products at ranges 14.7 and 16.5 μ and a proton of 4.5 mm range. The uranium concentration was determined from the observed density of α-particle tracks to be 2.8×10^{20} nuclei/cm^3 or 0.6% of all nuclei of the dry emulsion excluding hydrogen. (B.O.G.)

12162

POSITIVE PION PRODUCTION BY POLARIZED BREMSSTRAHLUNG. R. E. Taylor and R. F. Mozley (Stanford Univ., Calif.). Phys. Rev. 117, 835-45(1960) Feb. 1.

By selecting bremsstrahlung produced in a 0.003-in. aluminum radiator at a small angle from the original electron direction, a beam of polarized bremsstrahlung has been obtained from the Stanford linear accelerator. The variation of the polarization and intensity with angle was studied and compared with theoretical predictions. The polarized beam has been used to study π^+-meson production at 90° c.m. angle and photon energies of 242, 296, 337, and 376 Mev. The ratio of meson production along and at right angles to the electric field vector has been measured and compared with the values predicted by the relativistic dispersion relation. (auth)

12163

K^+ SCATTERING IN THE ENERGY RANGE 100–250 Mev. D. Fournet Davis, N. Kwak, and M. F. Kaplon (Univ. of Rochester, N. Y.). Phys. Rev. 117, 846-9(1960) Feb. 1.

Approximately 65 meters of K^+ meson track was scanned in the energy interval 100 to 250 Mev. Analysis of the data shows that the K^+-neutron charge exchange scattering rises appreciably above the value $1/5$ corresponding to a pure I = 1 interaction and at energies $\gtrsim 150$ Mev appears to be larger than the K^+-neutron direct scattering. Analysis of the angular distribution of the inelastic events for K^+ incident energies greater than 150 Mev indicates a non-isotropic center-of-mass angular distribution, peaked towards $\theta_{c.m.} = 180°$. (auth)

12164

K^--MESON ELASTIC SCATTERING BY EMULSION NUCLEI. D. Fournet Davis, N. Kwak, and M. F. Kaplon (Univ. of Rochester, N. Y.). Phys. Rev. 117, 850-3(1960) Feb. 1.

Data on elastic nuclear scattering of K^- mesons in emulsion was obtained. The differential cross section was calculated by the WKB approximation in the method of partial waves. The real and imaginary potentials necessary to give the correct K^- nucleon cross section also give a good fit to the elastic nuclear scattering data. (auth)

12165

CONNECTION BETWEEN NEUTRAL PION DECAY AND PROTON COMPTON SCATTERING. Maurice Jacob and Jon Mathews (California Inst. of Tech., Pasadena). Phys. Rev. 117, 854-8(1960) Feb. 1.

The inclusion of the single meson intermediate state significantly improves the agreement between theory and experiment for proton Compton scattering. Excitation functions and angular distributions for various assumed values of the π^0 lifetime are presented. On this basis one may definitely exclude π^0 lifetimes $>10^{-16}$ sec or $< 5 \times 10^{-19}$ sec. (auth)

12166

RECOIL PROTON POLARIZATION FROM 225-Mev π^-–p SCATTERING. J. F. Kunze, T. A. Romanowski, J. Ashkin, and A. Burger (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 117, 859-68(1960) Feb. 1.

Mesons (π^-) of energy 225 Mev were scattered from liquid hydrogen. The polarization of the recoil proton has been measured at two angles. The computed polarizations are -0.13 ± 0.16 at a laboratory recoil angle of 15°, and $+0.36 \pm 0.29$ at 31°. The positive sign is for polarization in the direction of the vector cross product of the incident meson (π) momentum and the recoil proton momentum. A comparison of the data is made with various sets of scattering phase shifts which represent the differential cross-section data equally well. The results favor the Orear type of Fermi set in which the S-wave α_1 phase shift is positive. (auth)

12167

SEVEN-DIMENSIONAL CHARGE SPACE. D. C. Peaslee (Australian National Univ., Canberra). Phys. Rev. 117, 873-86(1960) Feb. 1.

Some implications of a charge space of seven (rotational) dimensions are considered for (I) particle classification, (II) strong interactions, and (III) weak interactions. The conclusions from this point of view are that (I) all particles except the photon and graviton can be incorporated in 7 dimensional charge space; lepton conservation must be abandoned, which introduces parity nonconservation into β decay; (II) the one boson, two fermion interaction is pseudovector in form and induces no mass differences; the $\Sigma - \Lambda$ mass difference arises from interference with a fundamental two boson, two fermion interaction of lower charge symmetry; the $\Xi - N$ mass difference has an "intrinsic" basis and is not due entirely to strong interactions; (III) the weak universal Fermi interaction has signature −1 under time reversal; the strangeness change $\Delta S = \pm 1$ is associated with 256 independent (in principle) terms; the rule $\Delta I = \pm 1/2$ needs further qualification because I = T + U, where T and U are independent operators. (auth)

12168

INCONSISTENCY OF CUBIC BOSON-BOSON INTERACTIONS. Gordon Baym (Harvard Univ., Cambridge, Mass.). Phys. Rev. 117, 886-8(1960) Feb. 1.

It is shown that there does not exist a ground state for a system of spin zero bose fields coupled only by local interactions involving three powers of the fields. Thus these interactions alone are not suitable for a model of interacting fields. (auth)

12169

FOUR-FERMION INTERACTIONS WITH SPIN 3/2 NEUTRINOS. C. L. Hammer and R. H. Good, Jr. (Iowa State Univ. of Science and Tech., Ames). Phys. Rev. 117, 889-90(1960) Feb. 1.

Beta decay involving a spin $3/2$ neutrino in weak competition with the spin $1/2$ neutrino was investigated. This process could explain the deviations from allowed shapes in the Gamow-Teller interactions recently reported by Langer et al., but it would then be in disagreement with μ-decay observations. (auth)

12170

HYPERNUCLEUS STUDIES. I. MESONICALLY DECAYING HYPERNUCLEI. S. Lokanathan, D. K. Robinson, and S. K. St Lorant (Univ. of Oxford). Proc. Roy. Soc. (London) A254, 470-86(1960) Mar. 8.

A systematic study of 260,000 stars produced by 4.3 Bev/c negative π-mesons and of 1000 K-interaction stars, both in Ilford G 5 nuclear emulsion, yielded 46 hypernuclei decaying by the mesonic mode. The identification of these events is described and the binding energy of the Λ^0 hyperon in the nucleus is calculated in each case with the help of a program written for the Ferranti Mercury computer. The binding energies of the uniquely identified hypernuclei were found to be as follows: ${}_\Lambda H^3, B_\Lambda = 0.67 \pm 0.38$ Mev; ${}_\Lambda H^4, B_\Lambda = 1.94 \pm 0.28$ Mev; ${}_\Lambda He^5, B_\Lambda = 3.21 \pm 0.14$ Mev; ${}_\Lambda Li^9, B_\Lambda = 3.51 \pm 3.49$ Mev. All other events admit alternative interpretations, and the binding energies are tabulated for the various possibilities. Other experimental results are discussed. The quoted errors in the binding energies are random errors; contributions from systematic sources are discussed and they amount to about 0.3 Mev. (auth)

12171

DISPERSION RELATIONS AND HIGH ENERGY LIMITS IN QUANTUM FIELD THEORY. Seiya Aramaki (Tokyo Univ. of Education). Progr. Theoret. Phys. (Kyoto) 22, 485-91 (1959) Oct.

The high energy limits in quantum field theory are shown to be determinable starting from Bogoliubov's and Symanzik's dispersion relations if the Boson propagator and pion-nucleon forward scattering amplitude have no zero on their complex energy planes. A possibility excluding zeros is discussed using Nambu's method in perturbation theory. (auth)

12172

NUCLEON-NUCLEON SCATTERING IN MOMENTUM SPACE: OPEP AS EXAMPLE. Peter Signell (Bucknell Univ., Lewisburg, Penna.). Progr. Theoret. Phys. (Kyoto) 22, 492-8(1959) Oct.

A practical formalism is developed for treating nucleon-nucleon scattering in momentum space. The non-adiabatic one-pion-exchange potential is used as an example. (auth)

12173

A NOTE ON THE DISPERSION-THEORETIC APPROACH TO THE ONE ADDITIONAL PION PRODUCTION BY PION-NUCLEON COLLISION. Kin-ichi Ishida (Yamagata Univ., Japan). Progr. Theoret. Phys. (Kyoto) 22, 499-512(1959) Oct.

A "natural" frame of reference to derive the dispersion relation for the one additional pion production by pion-nucleon collision is introduced. It is a natural extension of what is introduced in the elastic pion-nucleon scattering. Thus, the retarded matrix element on the problem may be derived to be analytic on the upper half plane of the complex pion energy fixing the other independent four variables. Then the dispersion relation is derived connecting the dispersive parts and the absorptive parts. The absorptive parts are investigated. (auth)

12174

A LOWER LIMIT ON THE π^0 LIFETIME. Steven C. Frautschi (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 544-8(1959) Oct.

The assumption is made that the $\gamma + P \rightarrow \gamma + P$ scattering amplitude can be analytically continued to the pole arising from exchange of a π^0 between P and γ. Experiment limits the possible size of the residue at the pole, thus providing a lower limit $\tau \gtrsim 6 \times 10^{-19}$ sec on the π^0 lifetime. (auth)

12175

TWO-NUCLEON POTENTIAL WITH THE "ONE-PION-EXCHANGE TAIL." Tetsuo Hamada (Sydney Univ.); Junji Iwadare and Ryozo Tamagaki (Kyoto Univ.); Shoichiro Otsuki (Nagoya Univ., Japan); and Wataro Watari (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 22, 566-84 (1959) Oct.

It is shown that p-p single and double scattering up to 150 Mev can be reproduced by a potential with the "one-pion-exchange tail" in its outer part, without assuming any seriously energy-dependent interactions and spin-orbit coupling potentials. The intermediate part of the potential has all features that are characteristic of the two-pion-exchange potential. Qualitative reasoning of this potential is given together with the results of calculation. (auth)

12176

PHOTODISINTEGRATION OF THE ALPHA-PARTICLE. Tatuya Sasakawa (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 595-6(1959) Oct.

A wave function consistent with the binding energy of He^4 and giving the maximum (γ,p) cross section at the threshold energy was obtained by adopting the interaction given by meson theory and assuming the outgoing particle to be subject to the square well potential. This potential was adjusted to produce the p-wave resonance of this particle at the maximum cross section. The wave function is of the Gaussian type both for H^3 and He^4, and the parameters are $V_0 = 50$ Mev, $R = 2.0 \times 10^{-13}$ cm, $\mu = 0.15 \times 10^{26}$ cm^{-2}, and $\alpha = 0.14 \times 10^{26}$ cm^{-2}. The α particle is concluded to have an excited state ($^1P_1$-state) at about 26 Mev above the ground state. (D.L.C.)

12177

ON THE POSSIBLE ROLE OF $\pi^{0'}$-MESON IN DECAY PROCESS. Shoji Sawada and Minoru Yonezawa (Hiroshima Univ.). Progr. Theoret. Phys. (Kyoto) 22, 610-16(1959) Nov.

The existence of the heavy neutral pseudoscalar meson with isotopic spin zero ($\pi^{0'}$) is assumed and its effects on the K-meson decay are discussed. The K_e^+ experimental data are re-examined by assuming the K_{e3}^+ ($K^+ \rightarrow \pi^0 + e^+ + \nu$) and $K_{e3'}^+$ ($K^+ \rightarrow \pi^{0'} + e^+ + \nu$) modes. Analysis shows that the V-A Fermi interaction can give the energy spectrum of the electron consistent with the present experiments. (auth)

12178

PROPERTIES OF THE PION-PION INTERACTION DERIVED FROM THE ANALYSIS OF PION-NUCLEON SCATTERINGS. Iwao Sato, Atsushi Takahashi, and Yoshiki Ueda (Tohoku Univ., Sendai). Progr. Theoret. Phys. (Kyoto) 22, 617-37(1959) Nov.

The properties of π-π interaction are discussed by using dispersion relation techniques. New dispersion relations for π-N scattering are obtained by applying the reduction formula to the initial π and final N operators. In each of these relations, the absorptive part is divided into two parts, one of which is written as an integral of the π-π scattering amplitude multiplied by a certain matrix element similar to the π-N scattering amplitude, while the other is written in terms of the phase shifts for π-N scattering. If the π-π scattering amplitude is expressed in terms of unknown parameters, such as scattering lengths and effective ranges, their values can be determined by means of these dispersion relations. Thus, some knowledge about the sign and the strength of the π-π interaction may be obtained. In the isotopic spin state $I = 0$ of the π-π system, the interaction is found to be attractive and its scattering length to be of the same order of magnitude as that of the π Compton wave length. In the state $I = 1$, the interaction is also found to be attractive and comparable to the π-N interaction in the (3,3) state. (auth)

12179

EFFECT OF STRANGE PARTICLES ON THE S-WAVE PION-NUCLEON SCATTERING. Akira Komatsuzawa and Reiji Sugano (Kyoto Univ.) and Yukihisa Nogami (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 22, 638-42(1959) Nov.

Effect of strange particles on S-wave pion-nucleon scattering at low energies is examined qualitatively. This effect is shown to be too small to play an essential role in the suppression of the isospin-even part of the phase shift, but very important in the isospin-odd part. (auth)

12180

ON THE STRONG INTERACTION. Hironari Miyazawa and Hiroomi Umezawa (Univ. of Tokyo) and Tadao Nakano (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 22, 643-6(1959) Nov.

A series of equations is proposed for the description of strong hyperon-meson interactions, in which the global symmetry theory is rejected. (D.L.C.)

12181

ON THE RELATIVE PARITY OF CHARGED AND NEUTRAL K MESONS. Kanji Fujii and Hajime Tanaka (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto) 22, 704-14(1959) Nov.

The view-point that the mass difference between the particles belonging to the same charge multiplet is chiefly due to the oddness of the relative parity between charged and neutral K mesons, i.e., p(K) = odd, is shown, on the basis of the perturbation calculation, to be permissible under certain conditions. One of them is the equality of the relative parities of Λ, Σ's and Ξ's. In order to obtain some information about the parities of charged and neutral K mesons, various effects due to p(K) = odd, such as the mass difference between charged and neutral K mesons, are investigated. The result thus obtained is not inconsistent with $P(K^{\pm})$ = odd, which may be in agreement with the result obtained from the $K^{\pm}$-nucleon scattering experiment; the most favorable parity assignment to K mesons is $P(K^{+})$ = odd and $P(K^{0})$ = even. A comment is made about the assumption that the baryon spectrum known at present is closed. (auth)

12182

A POSSIBLE SYMMETRY IN SAKATA'S MODEL FOR BOSONS—BARYONS SYSTEM. Mineo Ikeda and Shuzo Ogawa (Hiroshima Univ.) and Yoshio Ohnuki (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto) 22, 715-24(1959) Nov.

A possible symmetry in Sakata's model for the strongly interacting particles is studied. In the limiting case in which the basic particles, proton, neutron, and Λ-particle, have an equal mass, theory holds the invariance under the exchange of p and Λ or n and Λ in addition to the usual charge independence and the conservation of electrical and hyperonic charge. The following are obtained: (a) iso-singlet π_0'-meson state, pseudo-scalar, exists, (b) the spin of Ξ-particle may be $(3/2)^{+}$, and (c) several resonating states in K- and π-nucleon scattering are anticipated to exist. (auth)

12183

COUPLING CONSTANTS IN β-DECAY AND NUCLEON STRUCTURE. Masami Nakagawa (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto) 22, 725-35(1959) Nov.

The difficulty concerning the renormalized axial vector coupling constant of β-decay with pionic corrections is analyzed from a simple model about the nucleon structure. In this model, the nucleon is supposed to consist of the 'nucleon core' of spin ½ and the pionic cloud, and the core is assumed to be composed of static bare N, $\bar{N}$ ensemble. An attempt is made to determine what restrictions are imposed on the wave functional of the nucleon core by the known values of β-decay coupling constants. In the case in which the states of the bare particle are restricted to s- and p-state, it is found that the three-body configurations $(NN\bar{N})$ play the predominant role in order to yield the maximum value of $G_A/G_V (\cong 1.38)$, the ratio of the axial vector- to the vector-coupling constant of the nucleon core. From this analysis, N-$\bar{N}$ configurations of iso-singlet and spin triplet are shown to be predominant. (auth)

12184

HIGH ENERGY SCATTERING OF NUCLEONS FROM NUCLEI. Tatuya Sasakawa (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 738-40(1959) Nov.

The impulse approximation is extended to cover the elastic scattering of high-energy nucleons from nuclei heavier than alpha particles. The positions of the first minima of the diffraction patterns of 340 Mev protons scattered from nuclei ranging from C to Bi and of 84 Mev neutrons scattered from Cu and Pb are calculated. The agreement between theoretical and experimental values is good. The uniform nuclear density assumption is shown to be valid for high-energy scattering. (D.L.C.)

12185

SOME REMARKS ON FEYNMAN'S VARIATIONAL METHOD. Mikio Namiki (Waseda Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 22, 740-2(1959) Nov.

Feynman's variational method is manipulated and applied to the one-particle Green function in the meson-nucleon system with ps coupling. (D.L.C.)

12186

IRRADIATION AT CHARGED PARTICLE TRANSIT NEAR IDEALLY CONDUCTIVE BODIES. I. N. Dnestrovskii and D. P. Kostomarov (Lomonosov Moscow State Univ.). Radiotekh. i Elektron. 4, 303-12(1959) Feb. (In Russian)

A generalized problem of electromagnetic oscillation radiation emission from charged particles, in flight in a vacuum near ideally conducting surfaces, was analyzed by nonrelativistic approximation. Formulas were derived for the radiation energy and spectra, and a detailed analysis is made of the problem of oscillation excitation in electron flight from open semi-space into a circular waveguide. (tr-auth)

12187

TRAJECTORY MODELLING OF RELATIVISTIC ELECTRONS IN MAGNETIC UNDULATOR. A. N. Vystavkin, J. V. Anisimova, and S. S. Shakhidzhanov. Radiotekh. i Elektron. 4, 550-1(1959) Mar. (In Russian)

Trajectories of relativistic electron beams in a magnetic undulator were studied with magnetic field distribution similar to the system described by H. Motz (J. Appl. Phys. 22, 9(1951)). The method can also be applied in other cases related to relativistic electron beams in complex magnetic fields. (R.V.J.)

12188

ON SOME PROPERTIES OF MEDIA WITH PERIODICALLY TIME-VARYING PARAMETERS ε AND μ. A. M. Markovkin. Radiotekh. i Elektron. 4, 785-91(1959) May. (In Russian)

An amplified concept is presented for parametric phenomena in media with varying parameters. The conditions of emission (absorption) are formulated for the case of electromagnetic wave propagation or localization in media with time-varying parameters and without outside electric or magnetic forces. (R.V.J.)

12189

BACK SCATTERING AND SECONDARY EMISSION DURING ELECTRON IRRADIATION OF DIFFERENT MATERIALS. Yu. A. Simchenko. Radiotekh. i Elektron. 4, 1381-6(1959) Aug. (In Russian)

The results and techniques of direct measurements of inverse scattering and secondary emission from cylindrical collectors of materials with various atomic numbers, irradiated with a $Sr^{90}-Y^{90}$ beta source of 210 μc, were investigated. The results of direct measurements are compared to data obtained with window counter and by measuring scattering from plane sources of monoenergetic beams with 1.0 and 1.2 Mev electrons. It is shown that the inverse scattering magnitudes obtained with window counters considerably exceed the direct measurements and that the total flux of inverse electron radiation of the collector is not a function of secondary emission magnitudes. (tr-auth)

12190

DIFFUSION THEORY FOR POLARIZED PARTICLES. L. Waldmann (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 15a, 19-30(1960) Jan. (In German)

The multiple elastic scattering of polarized particles is governed by a generalized Boltzmann equation. The properties of the collision brackets connected with this equation—definiteness and invariances—are studied. Then the state near equilibrium, i.e., nearly isotropic distribution of velocities and spins, is considered (diffusion theory). To describe an ensemble of spin ½ particles, one needs in the most simple non-equilibrium approximation two scalars (one pseudo) and four vectors (two pseudo). The scalars are density of number and helicity. The vectors are particle stream, density of velocity-spin vector (v × s), stream of helicity, and density of transverse spin. These scalars and vectors are connected by linear differential equations (diffusion–relaxation–equations). The entropy and the Onsager-Casimir relations are discussed. The theory, supplemented by boundary conditions, is applied on the multiple scattering of spin ½ particles by a thick foil. (auth)

12191

INVESTIGATION OF THE EFFECT OF THE HYPERFINE STRUCTURE ON POLARIZATION OF μ^- MESONS IN MESIC ATOMS. L. B. Egorov, A. E. Ignatenko, and D. Chultem (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1517-23(1959) Dec. (In Russian)

The angular distributions of μ^--meson decay electrons from aluminum, phosphorus, and carbon mesic atoms were studied with scintillation counters. It is shown that due to interaction of the hyperfine structure there is a decrease of the μ^--meson polarization. The results of the measurements do not contradict the theoretical predictions if depolarization exclusively on the K orbit of the mesic atom is taken into account. Comparison of the results of measurement for phosphorus with the results previously obtained for liquid hydrogen shows that the complete depolarization of μ^- mesons observed in hydrogen cannot be explained by the interaction between the fine and hyperfine structure alone. In order to do this an additional mechanism must be assumed (such as the "jumping" of a μ^- meson from one proton to another one with concurrent transition of the hyperfine structure to the ground state). All experimental data on depolarization of μ^- mesons in various substances can be explained theoretically if it is assumed that in mesic atoms of metals the electron shell does not affect the depolarization of μ^- mesons. The presence of a fine and hyperfine structure in mesic atoms is confirmed and this again indicates that the electromagnetic properties of mesons and electrons are similar. The reduction of precession frequency of the mesic nucleus spin by a factor of two observed in experiments with phosphorus, as compared with precession frequency of the free μ-meson spin indicates directly that the spin of a negative μ meson is equal to ½. (auth)

12192

SEARCH FOR PARTICLES WITH MASSES BETWEEN 6 AND 25 ELECTRON MASSES. A. S. Belousov, S. V. Rusakov, E. I. Tamm, and P. A. Cherenkov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1613-18(1959) Dec. (In Russian)

Experiments are described which were performed with the view of elucidating whether γ quanta generate particles with masses lying between 6 and 25 electron masses, in accord with the production cross sections predicted by the electromagnetic theory of pair production. For this purpose fast coincidence circuits were employed to measure the time of flight of particles with a given momentum between two scintillation counters. The particles were generated in a lead target placed in the bremsstrahlung beam from a synchrotron. The theoretical coincidence counting rate was compared with the experimental rate obtained for parameters of the experimental arrangement corresponding to registration of particles with the expected mass. In each set of experiments the ratio of the electron counting rate to the background rate was also measured. The results obtained show that the cross sections for production of particles with unit charge, spin ½ and masses lying between 6 and 25 m_e are not those predicted by electromagnetic theory. (auth)

12193

POLARIZATION PHENOMENA IN RADIATIVE COLLISIONS OF TWO ELECTRONS. V. L. Lyuboshitz (Voronezh State Univ., USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1727-40 (1959) Dec. (In Russian)

Two-row matrix formalism is used for the description of polarization phenomena in the collision of two Dirac particles of arbitrary energy. The radiative collision of two polarized electrons is considered. The structure of the general formulas for the polarization parameters after the collision is investigated, and concrete calculations are carried out in the ultra-relativistic and nonrelativistic limits taking into consideration polarization of the target electrons. (auth)

12194

ELECTRON AND MUON NEUTRINOS. B. Pontekorvo (Pontecorvo) (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1751-7(1959) Dec. (In Russian)

Some processes due to free neutrinos which heretofore had not been considered are discussed. Especial attention is given to those processes which in principle may help to solve the problem concerning the existence of two neutral lepton pairs (electron pair (ν_e and $\bar{\nu}_e$) and muon pair (ν_μ and ν_μ^-)). To solve the fundamental question of whether ν_μ and ν_e are identical particles, a method is proposed which in essence is analogous to the method employed for solving the problem of the distinguishability of the neutrino and antineutrino or K^0 and $\bar{K}^0$ mesons. In principle the problem can be solved if it is demonstrated experimentally that a $\bar{\nu}_\mu$ beam is capable of inducing transitions which $\bar{\nu}_e$ particles can certainly induce (e.g., the $\bar{\nu}_\mu + p \rightarrow e^+ + n$ reaction). The experiment suggested above, although difficult, should be feasible with accelerators capable of producing more intense beams than those produced by present day accelerators. (auth)

12195

ON THE THEORY OF β DECAY OF THE NEUTRON. S. M. Bilenskii, R. M. Ryndin, Ya. A. Smorodinskii, and Ho Tso-hsiu (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1758-63(1959) Dec.

Calculations are performed for corrections to various effects in β decay of the neutron originated by terms $\sim m/M$ (m and M are the electron and nucleon masses) which are due to the "weak Gell-Mann magnetism" and proton recoil. It is shown that for electron–neutrino correlation and the up-down asymmetry of electrons these corrections may reach several per cent. (auth)

12196

ANALYTICITY AND UNITARITY IN THE SCATTERING OF SCALAR MESONS ON A STATIC NUCLEON. B. L. Ioffe. Zhur. Eksptl'. i Teoret. Fiz. 37, 1764-9(1959) Dec. (In Russian)

The uniqueness of the determination of the scattering amplitude from the analyticity and unitarity conditions is considered for the problem of scattering of scalar neutral and charged mesons on a static nucleon in the one-meson approximation. The analysis is carried out by prescribing the analytic properties of the scattering amplitude over the complete Riemann multisheeted surface. As a result it is found that the nonuniqueness of the solution may be of the nature of virtual or Breit-Wigner levels. (auth)

12197

ON K_{e4} DECAY. L. B. Okun and E. P. Shabalin. Zhur. Eksptl'. i Teoret. Fiz. 37, 1775-80(1959) Dec. (In Russian)

The probabilities for K_{e4} decays are computed. The selection rules for the decays and the isotopic relations between various K_{e4} decays are determined on basis of the Sakata model. (auth)

12198

A BIBLIOGRAPHY ON HEAVY MESONS AND HYPERONS. Bruno Vitale. Amsterdam, North-Holland Publishing Company, 1960. 146p. $2.50.

A bibliography is presented on the properties of heavy mesons and hyperons, covering papers published between 1946 and 1958. (C.J.G.)

12199

MEASUREMENT OF THE POLARIZATION OF D-D NEUTRONS BY A SOLENOID. Pieter Steven Dubbeldam. Thesis, Amsterdam, Free University, 1959. 85p.

A method of measuring the polarization of fast neutrons from the d-d reaction is presented and discussed. (Reactor Centrum Nederland).

12200

FAST NEUTRON PHYSICS. PART I: TECHNIQUES. J. B. Marion and J. L. Fowler, eds. Interscience Monographs and Texts in Physics and Astronomy. Volume IV. New York, Interscience Publishers, Inc., 1960. 995p. $29.00.

The primary purpose of this book is that of a reference work. Enough detail is included to make it of interest and of use to all those whom the field of nuclear energy brings in contact with neutrons. The boundary between fast and slow neutrons was taken for this work to be 1 kev neutron energy. While the upper limit of the neutron energy range is considered to be about the threshold for nonelastic nucleon-nucleon collisions (i.e., several hundred Mev), most of the material pertains to the region below 40 Mev. Polyenergetic neutrons are discussed, but monoenergetic neutrons and their interactions with nuclei are emphasized to a greater extent. Part I of this work is comprised of discussions on: neutron sources, both natural and artificially radioactive; neutron detection by recoil methods and by neutron-induced reactions; and special techniques and problems, e.g., time-of-flight techniques, flux measurements, target preparations, neutron shielding, electronic computer methods, and general problems in health physics resulting from work with neutrons. (B.O.G.)

Nuclear Properties and Reactions

12201 CEA-1195

France. Commissariat à l'Énergie Atomique, Paris.

EMISSION DES NEUTRONS PROMPTS DE FISSION. (Prompt Neutron Emission). R. Sher. Apr. 1959. 19p.

It is shown that Ramanna and Rao's tentative conclusion that prompt fission neutrons are emitted (in the fragment system) preferentially in the direction of fragment motion is not necessitated by their angular distribution measurements, which are well explained by the usual assumptions of isotropic emission with a Maxwell (or Maxwell-like) emission spectrum. The energy distribution (Watt spectrum) and the angular distribution, both including the effects of anisotropic emission, are given. (auth)

12202 CEA-1202

France. Commissariat à l'Énergie Atomique, Paris.

ETUDE DU SPECTRE γ DES PRODUITS DE FISSION DANS LA BANDE 0—500 Kev. (Study of Fission Product γ Spectra in the Band 0—500 kev). A. Rousseau. 1959. 47p.

In a study of the γ spectrum of uranium fission products, particular attention was given to the part of the spectrum ranging between 0 and 500 kev after a given pile operating program and the evolution of this spectrum with time after a pile shut-down has been followed. The study is related to the fission products which appear in the pile as a whole or on those produced in a uranium sample assumed to have been placed in the pile. The latter case has been envisaged here. The spectrum determination is based partly on theory and partly on experiment. The pile operating conditions are different in the two cases, which widens the range of validity of the spectra traced. (auth)

12203 CERN-60-3

European Organization for Nuclear Research, Geneva.

THE CROSS-SECTION OF THE REACTION $Al^{27}(p,3pn)Na^{24}$ AT 590 MeV. K. Goebel and H. Schultes. Feb. 2, 1960. 27p.

A method of determining the absolute cross section of the $Al^{27}(p,3pn)Na^{24}$ reaction is considered. Using a calibrated ion chamber, the sensitivity of a secondary emission chamber was determined. The SE chamber monitored a well focussed proton beam of defined energy (590 Mev) which at the same time passed through an aluminium target. The Na^{24} activity induced by the proton bombardment of the aluminum foil was measured with counters of well defined counting efficiency. A cross section of 11.0 ± 0.5 mb was measured. This value fits exactly those already known for 350 Mev (11.1 ± 0.9 mb) and 2 Bev (10.4 ± 0.6 mb) or 3 Bev (10.0 ± 0.6 mb). According to the figures the excitation curve of the $Al^{27}(p,3pn)Na^{24}$ reaction may be considered, either as a slowly decreasing function of the energy, or even to be constant in the range from 0.4 to 3.0 Bev. (auth)

12204 NP-8396

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.

THE REACTION $d + d \rightarrow \pi^0 + He^4$ AT THE DEUTERON ENERGY OF 400 MeV. Yu. Akimov, O. V. Savchenko, and L. M. Soroko. 1959. 11p. (P-422).

A method of checking the charge invariance principle consists in establishing the degree of forbiddenness resulting from the conservation of isotopic spin in meson production processes. The reaction $d + d \rightarrow \pi^0 + He^4$ serves as an illustration of this principle. Measurements on the reaction were made at an extracted deuteron beam intensity of about 3×10^{10} sec^{-1}. (W.D.M.)

12205 NP-8411

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.

THE EFFECT OF QUADRUPLE CORRELATIONS IN LIGHT NUCLEI. V. G. Solov'ev (Soloviev). 1959. 15p. (P-437).

The quadruple correlations of nucleons possessing equal energies were treated on the basis of the effective Hamiltonian describing the pairing interactions between nucleons. It is shown that the appearance of the quadruple correlations in light nuclei is energetically lower if the pairing interaction is attractive. With account of the pairing and quadruple correlations some regularities concerning the binding energy of the last neutron in light nuclei have been explained. A criterion has been obtained which showed what number of neutrons has to exceed that of protons in stable nuclei (due to the extension of Fermi surfaces for neutrons and protons) for explicit α-particle properties of nuclei to disappear. (auth)

12206 NP-8461
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.
THE FORM FACTOR AND THE μ-CAPTURE BY LIGHT NUCLEI WITH $^1/_2$ SPIN. Tso-hsiu Ho. 1959. 12p. (P-435).

Various effects connected with the capture of μ mesons by light nuclei with spin $^1/_2$, not involving nucleon emission, are investigated. Calculations show that the form factor gives a significant correction to these effects. (auth)

12207 NP-8479
Illinois. Univ., Urbana. Physics Research Lab.
THE PHOTONEUTRON CROSS SECTION NEAR THRESHOLD (thesis). Technical Report No. 13. P. Axel and J. D. Fox. Feb. 1960. 192p. Contract Nonr-1834(05).

An experimental and theoretical study of photoneutron cross sections near threshold is described. It is shown that photonuclear measurements can be used to determine such nuclear properties as neutron binding energies, spins and parities of energy levels, relative widths of different decay modes of states formed by photon absorption, and electromagnetic transition probabilities. The experimental apparatus is discussed. Decay schemes of the nuclides Zr^{90}, Mo^{92}, and Br^{81} are presented. (W.D.M.)

12208 OSR-TN-59-1323
Washington Univ., St. Louis.
A MEASUREMENT OF THE LONGITUDINAL POLARIZATION OF Pr^{144} BETA-PARTICLES (thesis). Technical Report No. 26. Werner Alfred Wilhelm Mehlhop. Sept. 1959. 112p. Project No. 37504. Contract AF18(603)108.

A precision determination of the longitudinal polarization of β particles from Pr^{144} is reported. Available information about Y^{90} and Pr^{144} is summarized and β-decay theory is discussed. The polarization-sensitive Moeller scattering process was used in which the β particles are scattered off a ferromagnetic foil and percentage difference in Moeller events for reversal of the magnetic field is observed. A major feature of the apparatus is the detection of the two final state electrons in fast coincidence. The result obtained was P (Pr^{144}) = (0.986 ± 0.030) v/c. (T.R.H.)

12209 TID-5732
Purdue Univ., Lafayette, Ind.
DECAY OF Si^{26}. E. L. Robinson and O. E. Johnson. [1960]. 33p. Contract [AT(11-1)-122]. OTS.

A 2.1 ± 0.3-sec activity was observed when vacuum distilled magnesium was bombarded with 8-Mev He^3 ions. Half-life studies using NaI(Tl) scintillation counters yielded evidence that this activity was due to the decay of a positron emitting isotope with a maximum kinetic energy greater than 3.5 Mev. The features of gamma-ray spectrum with the exception of a weak line at 824 ± 15 kev could be understood in terms the decay characteristics of known radioisotopes. An internally consistent argument based on the known decay characteristics of reaction products that may be expected from energy considerations; the results of half-life studies; experimental gamma spectra; and nuclear systematics, can be made to support the conclusion that the 2.1 ± 0.3-sec half-life is that of Si^{26} produced in the reaction Mg^{24}(He^3,n)Si^{26}, and a consistent decay scheme can be proposed. The ground state of Si^{26}(0+) decays by the emission of two positron groups to excited states of Al^{26}. The most intense transition, E_0 = 3.76 Mev, is to the 0.228-Mev state (0+) of Al^{26}. The second transition, E_0 = 2.94 Mev, is to the 1.05-Mev state (1+) of Al^{26}. The 1.05-Mev and 0.228-Mev state are then connected by a 824 ± 15-kev gamma transition. The energies of the positron transitions are derived from the known levels of Al^{26} and the Si^{26}-Al^{26} mass differences. (auth)

12210
CONTRIBUTION TO THE STUDY OF ELECTRIC DIPOLAR TRANSITIONS IN THE REGION OF THE RARE EARTHS. (DISINTEGRATION OF Gd^{153}, Eu^{155}, Tb^{161}, and W^{187}). Michel Vergnes (Université, Paris). Ann. phys. (13) 5, 11-69(1960) Jan.-Feb. (In French)

The existence, in the region of deformed nuclei, of low-energy electric dipolar transitions, whose probabilities are very low compared with the Weisskopf theoretical predictions, can not be explained in the framework of the independent particle model. New examples of such transitions in the rare earth region (150 < A < 190) were searched for and the slowing of the transitions was explained with the Nilsson model which considers the nuclear deformation. The study of the probability of electric dipole transitions necessitates the measurement of the transition conversion coefficients, measurement of the period of excited levels, and the precise knowledge of the energy levels of the nuclei studied. The experimental results were obtained with a "fast-slow" coincidence system. Four disintegrations were studied: Gd^{153} → Eu^{153}, Eu^{155} → Gd^{155}, Tb^{161} → Dy^{161}, and W^{187} → Re^{187}. Energy levels were proposed, and the conversion coefficients of the majority of the photons were measured. The 98-kev level of Eu^{153} (half life ≤ 10^{-9} sec) is de-excited by an E1 transition (conversion coefficient $\alpha_K = 0.3 \pm 0.1$) to the ground level. The 86.5-kev level of Gd^{155} (half life $(5 \pm 1) \times 10^{-9}$ sec) is de-excited by an E1 transition (conversion coefficient $\alpha_K = 0.4 \pm 0.1$) to the ground level. The 105.4-kev level of Gd^{155} (half life 1.2×10^{-9} sec) is de-excited by an E1 transition (conversion coefficient $\alpha_K = 0.75$) to the ground level. The 25.5-kev level of Dy^{161} (half life $(2.7 \pm 0.2) \times 10^{-8}$ sec) is de-excited by an E1 transition (conversion coefficient $\alpha_{total} < 3.3$) to the ground level. The 74.5-kev level of Dy^{161} (half life $1.6 \times 10^{-9} < T_{1/2} \leq 3 \times 10^{-9}$ sec) is de-excited by an E1 transition (conversion coefficient $\alpha_{total} < 2.75$) to the ground level and by a M1 + E2 transition to the 25.5-kev level. The 206-kev level of Re^{187} is de-excited by an E1 transition of 72-kev (conversion coefficients $\alpha_K = 1.4 \pm 0.2$ and $\alpha_{L_1+L_2} = 0.23 \pm 0.13$) to the first rotation level of the ground level. The period of the 206-kev level was verified as $T_{1/2} = (5 \pm 1) \times 10^{-7}$ sec. These results and all other known results concerning electric dipolar transitions in this region are tabulated. The experimental values are compared with the theoretical predictions of Weisskopf and with calculations made within the framework of the Nilsson model. Most of the experimental results are in good agreement with the calculations, but some divergences show that it is necessary to improve the model by taking into consideration the pair coupling energy of two nucleons. (tr-auth)

12211
CONTRIBUTION TO THE STUDY OF NUCLEAR SPECTROSCOPY BY THE COINCIDENCE METHOD. APPLICATION TO THE DISINTEGRATION OF Rh 101 AND 102, TO THE EVALUATION OF K CAPTURE TO L CAPTURE RATIOS, AND TO THE DETERMINATION OF CONVERSION COEFFICIENTS. Nils Noel Perrin (Université, Paris). Ann. phys. (13) 5, 71-130(1960) Jan.-Feb. (In French)

The problems posed by the study of radioelements created by (d,n) reactions on ruthenium have led to the study of two types of phenomena very distinct from the theoretical view but closely connected from the experimental view:

the measurement of conversion coefficients of the γ radiation and the ratios of electron captures in the K level to captures in the L + M levels. The measurement methods used for Rh^{102} and Rh^{101} were extended to Zn^{65}, Se^{75}, In^{114}, and Eu^{152}. For the measurement of the conversion coefficients a very general method is given which allows, with the aid of β spectrometer with uniform field operating in coincidence, the measurement of the number of electrons emitted by the excited state of the transition studied. The apparatus used is described in detail. (tr-auth)

12212

NUCLEI WITH ODD MASS NUMBER A AND CHARGE NUMBER Z IN THE REGION WHERE A IS NEAR 190. Louis Feuvrais (Université, Paris). Ann. phys. (13) 5, 181-224(1960) Jan.-Feb. (In French)

For nuclei in which the number of neutrons is 88 to 90 (A is approximately 150), a sharp variation of their properties is produced: the energy of the collective excited level and the Coulomb excitation cross section vary. This discontinuity indicates the passage from the almost spherical form to the ellipsoidal form. The possible existence of the inverse passage in the region of the magic number Z = 82 and N – 126 was studied. The energy levels of three nuclei in the region of A = 190 : Ir^{191}, Ir^{193}, and Au^{197} were measured. First, the definition of the characteristic nuclear magnitudes necessary for the comprehension of the study and the expressions resulting from the shell model and the unified Bohr-Mottelson-Nilsson model are reviewed. The decay of Os^{191} was studied to determine the maximum energy and complexity of the β^- spectrum, the K/L ratio and conversion coefficient of the 129-kev photon, and the nature of 42-kev photon. The decay of Os^{193} was studied to explain the disagreement between the configuration of the $g_{7/2}$ level and the shell and unified models and to define the nature of the 558-kev photon. A direct measurement of the conversion coefficient of the 191-kev photon in the decay of Hg^{197} was made. A coherent scheme of the excited levels of Ir^{193} was established. The examination of the systematics of nuclei with mass number approximately 190 showed that the configuration of the ground level and first excited $^1/_2$ level of Ir and Au nuclei can be interpreted with the shell model. The unified model takes into account the shape of the energy variation of the 11/2– and 1/2+ levels and the filling of the $h_{11/2}$ level for Au and Ir nuclei. The transition probabilities measured were in excellent agreement with the theoretical calculations based on the Nilsson wave functions. In its collective aspect the unified model permits the conclusion that the inertia moments of rotation families based on the ground level presents a sharp discontinuity during the passage from Ir to Au, corresponding to the filling of the $h_{11/2}$ level. The energy of the first excited level of rotation families based on 1/2 particle level is compatible with a decoupling factor in excellent agreement, for Re^{185}, Ir^{191}, Ir^{193}, Au^{193}, Au^{195}, and Au^{197}, with the theoretical predictions of Nilsson. The discontinuity observed in deformation of nuclei during the passage from Ir to Au does not introduce a sharp variation of the intrinsic structure or of the characteristic nuclear magnitudes. It appears that for nuclei passing from Re (deformed nuclei) to Au (almost spherical nuclei) the unified model only can give a coherent interpretation of experimental data. (J.S.R.)

12213

NUCLEAR PHOTODISINTEGRATION. D. H. Wilkinson (Clarendon Lab., Oxford). Ann. Rev. Nuclear Sci. 9, 1-28(1959).

A compilation of experimental data on nuclear photodisintegration of the deuteron and of very light nuclei is presented. Various sum rules are discussed. The explanations of the giant resonance region according to the collective and independent particle models are analyzed. Experimental and calculated (both models) energies E_m and widths Γ of the giant resonance region are compared. Previous applications of the independent particle model to the prediction of photoreaction products are analyzed. (C.J.G.)

12214

HIGH-ENERGY NUCLEAR REACTIONS. J. M. Miller (Columbia Univ., New York) and J. Hudis (Brookhaven National Lab., Upton, N. Y.). Ann. Rev. Nuclear Sci. 9, 159-202(1959).

A review of the inelastic interactions between complex nuclei and nucleons with energies in excess of 100 Mev is presented, with emphasis placed on the nuclei and nucleons emitted. The theoretical aspects of high-energy reactions in terms of optical model are discussed. The measurement of the total inelastic cross section for the interaction of high-energy particles with complex nuclei is discussed. The relative isobaric yields and the mass-yield distribution of spallation and fission products from high-energy reactions are reviewed. The mechanisms of light-particle emission and fragmentation are discussed. (C.J.G.)

12215

NUCLEAR FISSION. I. Halpern (Univ. of Washington, Seattle). Ann. Rev. Nuclear Sci. 9, 245-342(1959).

The probability of nuclear fission is reviewed relative to spontaneous fission half lives, penetration of the fission barrier, fission with slow neutrons, fission at moderate and high excitation energies, fission cross sections near the threshold, and the fission of elements lighter than thorium. The energy available for fission and the kinetic and excitation energies of fission fragments are discussed. The fission process as it is characterized by the distribution in mass, charge, energy, and angle of the fission products is considered. (C.J.G.)

12216

HEALTH HAZARDS FROM FISSION PRODUCTS AND FALLOUT. II. GAMMA RADIATION FROM NUCLEAR WEAPONS FALLOUT. Rolf Björnerstedt (Research Inst. of National Defence, Stockholm). Arkiv Fysik 16, 293-313 (1960). (In English)

Methods of estimating the gamma radiation from fallout and fission products are discussed. Gamma spectra and 0.1 Mev energy intervals for 10^4 fissions were calculated for the following times after fission: 1, 2, 5, and 10 hours; 1, 2, 5, 10, 30, and 100 days; and 1, 3, 10, 30, and 100 years. Fifty energy groups of width 1.300 to 1.399 Mev were used, covering the range 0.0 to 5.0 Mev. Calculations are presented on the thermal neutron fission of U^{235}, fission neutrons, and fission with 14 Mev neutrons. (C.J.G.)

12217

URANIUM NUCLEI COMPLEX FISSION BY 2.5 MEV NEUTRONS. Z. I. Solov'eva. Atomnaya Energ. 8, 137-8 (1960) Feb. (In Russian)

General data on U^{235} complex fission by 2.5-Mev neutrons do not differ greatly from data for other neutron energies. The fission is asymmetric, the mean ratio of heavy and light fragment tracks is $R_l/R_h = 1.3$. The angular distribution of α particles in relation to the direction of light fragment emission indicates deflection of 90° toward the light fragment. The distribution of α particles has a wide maximum with $R_\alpha = 130\ \mu$, corresponding to an energy of 16 Mev. (R.V.J.)

12218

2.5 AND 14.6 MEV NEUTRON CROSS SECTIONS OF Th^{230}, Pu^{240}, Pu^{241}, AND Am^{241}. M. I. Kazarinova, Yu. S. Zamyatin, and V. M. Gorbachev. Atomnaya Energ. 8, 139-41(1960) Feb. (In Russian)

Cross sections for Th^{230}, Pu^{240}, Pu^{241}, and Am^{241} fission by 2.5 and 14.6 Mev neutrons were measured in order to determine and verify the dependence of the neutron energy band f on A (at constant Z) and f(A). The isotopic compositions of thorium and americium were measured by mass spectroscopy. The quantity of Th^{230}, Pu^{240}, and Am^{241} was determined by the number of emitted α particles and by the number of spontaneous fissions. The cross section of Pu^{241} fission by slow neutrons was 1025 ± 10 barns. Cross sections for 14.6-Mev fission were measured by the absolute method. The cross sections of Th^{230} fission by 2.5-Mev neutrons were measured in relation to Th^{232}. The cross sections of Th^{230} fission by 2.5-Mev neutrons were measured in relation to Th^{232}. The cross sections of Pu^{240}, Pu^{241}, and Am^{241} were measured relative to U^{235}. The data are tabulated and correlated with available published data. (R.V.J.)

12219

A STUDY OF NEUTRON INTERACTIONS WITH He^4, C^{12}, AND O^{16} NUCLEI USING AN OPTICAL NUCLEAR MODEL. E. Ya. Mikhlin and V. S. Stavinskii. Atomnaya Energ. 8, 141-3(1960) Feb. (In Russian)

An attempt is made to adapt an optical model to detailed descriptions of elastic neutron scattering on He^4, C^{12}, and O^{16} at ~20, ~10, and ~6 Mev, respectively. Small absorption cross sections in the examined energy range permit the use of elastic neutron scattering on light nuclei at low energies, which must be related to the special stability of the nuclei. (R.V.J.)

12220

THE REACTION $K^{40}(n, p)A^{40}$. Jacques Weber and Jean Rossel (Université, Neuchâtel, Switzerland). Bull. soc. neuchâtel. sci. nat. 82, 161-89(1959). (In French)

The $K^{40}(n,p)Ar^{40}$ reaction was studied by the sandwich method; the target was a thin polycrystalline layer of enriched KCl (K^{40} isotopic abundance = 3.64%) placed between two Ilford C_2 50 μ nuclear emulsions. The slow neutrons used for irradiation were produced with an energy $E_n = 0.054$ ev by the Pb crystal monochromator of the Atomic Center of Saclay (France). The protons of the reaction $N^{14}(n,p)C^{14}$ with a cross section taken for that energy as (1.19 ± 0.03) b. were used for the calibration of the total neutron flux. The experimental value of the proton energy is (2.24 ± 0.09) Mev in good accord with that calculated from mass values (2.18 ± 0.02) Mev. The cross section was found to be (3.27 ± 0.73) b. for $E_n = 0.054$ ev. The proton angular distribution shows no measurable anisotropy. The evaluation of the total potential barrier penetration T_l gives a value for the level spacing D* of the compound nucleus at the excitation energy of 9.9 Mev. From the comparison of that value with those predicted by the semitheoretical formulas, it is concluded that the level involved in the reaction has a spin J = 9/2 and odd parity. The protons are produced with an angular momentum l = 5. The creation of the nucleus Ar^{40} in the first excited state 2^+ could not be observed with the present experimental method, the tracks of the emitted 0.7 Mev protons being too short. The cross section for that reaction is probably of the order of one tenth of a barn. (auth)

12221

ANGULAR DISTRIBUTION OF 5.45 Mev PROTONS SCATTERED ELASTICALLY BY NICKEL, COPPER AND COBALT ISOTOPES. N. Ya. Rutkevich, V. Ya. Golovnya, A. K. Val'ter, and A. P. Klucharev (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Doklady Akad. Nauk S.S.S.R. 130, 1008-11(1960) Feb. 11. (In Russian)

Angular distributions of protons elastically scattered by Co^{59}, Ni^{58}, Ni^{60}, Ni^{62}, Ni, and Cu^{65} at 5.45 Mev, which is about 1.5 Mev below potential level, were measured. The variable results for sub-barrier energy protons elastic scattering on even-even and odd-odd isotopes indicate specific nucleon-nuclei interaction for each nuclide. Consequently the optical model, even with supplementary spin-orbit sign in the interaction potential, cannot satisfactorily describe nucleon-nucleus interactions. (R.V.J.)

12222

ENERGY SPECTRUM AND ANGULAR DISTRIBUTIONS OF NEUTRONS FROM THE REACTION $Be^9(p,n)B^9$ AT 8 TO 14 Mev OF PROTON ENERGIES. Yoshio Saji (Univ. of Tokyo). J. Phys. Soc. Japan 15, 367-71(1960) Mar.

The $Be^9(p,n)B^9$ reaction has been studied by using a fast neutron spectrometer with a hydrogen gas radiator. The energy spectrum of neutrons from the reaction at 14.1 Mev was obtained and three new excited levels (3.07, 4.14, and 4.94 Mev) in B^9 were observed. They are consistent with the levels of the mirror nucleus, Be^9, and the level scheme of intermediate coupling model introduced by Kurath. The angular distributions of the neutrons at 8.1 to 14.1 Mev were obtained. The results do not agree with the theory of Austern, Butler, and McManus. The isotropic parts of the neutron angular distributions become larger as the incident proton energies decrease, probably due to the fact that in the lower energy region compound nucleus formation is more preferable. (auth)

12223

DECAY OF Cl^{34m}. Tsutomu Tōhei (Tohoku Univ., Sendai). J. Phys. Soc. Japan 15, 372-6(1960) Mar.

The gamma rays following the decay of chlorine-34 were studied with a scintillation spectrometer. Samples were produced with a betatron by the $Cl^{35}(\gamma,n)Cl^{34}$ reaction. Gamma rays of 1.17, 2.14, 3.32 Mev, and weak three gamma rays of 0.64, 0.77, and 4.10 Mev were found. The relative intensities are I(1.17 Mev) : I(2.14 Mev) : I(3.32 Mev) : I(4.10 Mev) = 32 : 100 : 32 : 1.0. (auth)

12224

INTERNAL IONIZATION PHENOMENON BY BETA EMISSION TREATED AS A CASE OF SUDDEN PERTURBATION. F. Grard (Faculté Polytechnique, Mons, Belg.). Mém. publs. soc. sci., arts et lettres Hainaut. 72, No. 2, 29-79(195?). (In French)

The phenomenon of internal ionization by β emission has been treated up to now as a case of sudden variation of nuclear charge during β decay. Actually, the transition is brought about stepwise by the fact that the nucleus ejects a charged particle with a finite velocity. A determination was made of the contribution to self-ionization probability of the coulomb interaction between the β particle and the atomic electron. This is of interest because of the hypothesis that the β particle can be treated as a center of point force. The evaluation was made using non-relativistic hydrogenoid wave functions. The results show that this contribution is important in the case of heavy β emitters. A method is pointed out, based on β particle representation by suitable wave functions, which allows a more rigorous analysis of the coulomb interaction between β particles and atomic electrons. An expression for the self-ionization probability was established by taking a plane wave for representation of the β particle. (tr-auth)

12225

ISOTOPE SHIFT IN THE Mo SPECTRUM. Hack Arroe and John M. Cornwall (Univ. of Denver). Phys. Rev. 117, 748 (1960) Feb. 1.

The isotope shift in the molybdenum spectrum was measured with a Fabry-Perot interferometer, using separated isotopes. For the line 16 578K, a definite minimum isotope shift of -8.9 mK was observed between Mo^{96} and Mo^{97}. The negative sign indicates that the direction of the shift is opposite to that predicted by the volume effect. (auth)

12226

DISTORTED WAVE METHOD FOR ELECTRON CAPTURE FROM ATOMIC HYDROGEN. R. H. Bassel (Univ. of Pittsburgh) and E. Gerjuoy (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. 117, 749-56 (1960) Feb. 1.

The distorted wave method, in which distorted waves replace plane waves in the matrix elements for the collision amplitude, is given a rigorous formulation for arbitrary rearrangement collisions. In atomic collisions involving electron rearrangement, the formulation enables removal of the unphysical internuclear Coulomb interaction from the "perturbation" hamiltonian. The procedure is applied to the problem of electron capture by protons in atomic hydrogen, eliminating explicit dependence on the proton-proton interaction. Numerical results of a first order calculation are in good agreement with experiments from 35 to 200 kev. (auth)

12227

CHARGE TRANSFER IN MOLECULAR HYDROGEN. T. F. Tuan (Univ. of Pittsburgh) and E. Gerjuoy (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. 117, 756-63(1960) Feb. 1.

The effects of the molecule on electron capture by protons in hydrogen gas were investigated in the first Born approximation with different types of electron wave functions. It appears that charge transfer in H_2 at high energies bears no simple relationship to charge transfer in atomic hydrogen. In particular, among other effects (i) in the high-energy limit $\frac{1}{2}\sigma_M = 1.2 - 1.4\sigma_A$; (ii) at lower energies there is important interference between the capture amplitudes from the two atoms in the molecule. It also is found that transitions to ungerade states of H_2^+, although unimportant in the energy range of present experiments, become appreciable at high energies. (auth)

12228

PHOTODISINTEGRATION OF THE DEUTERON WITH 94-MEV BREMSSTRAHLUNG RADIATION. J. A. Galey (Univ. of Chicago). Phys. Rev. 117, 763-72(1960) Feb. 1.

Differential cross sections for the reaction $\gamma + d \rightarrow p + n$ were determined at laboratory angles of 45°, 75°, 90°, and 135° for laboratory photon energies from approximately 50 to 90 Mev. At each of the above angles the energy spectrum of the recoil protons was determined with a counter telescope and a pulse-height analysis system. The differential cross sections and the estimates of the parameters describing angular distributions are in reasonable agreement with recent calculations by de Swart and Marshak and by Zernik, Rustgi, and Breit. (auth)

12229

$p'-\gamma$ ANGULAR CORRELATION IN THE INELASTIC SCATTERING OF 16.6-Mev PROTONS BY Mg^{24}. Hajimé Yoshiki (Princeton Univ., N. J.). Phys. Rev. 117, 773-80 (1960) Feb. 1.

The angular correlation between the inelastically scattered protons leaving the first excited state of Mg^{24} (1.37 Mev, 2+) and its de-excitation gamma rays produced by the bombardment of 16.6-Mev protons on a natural magnesium target was investigated. For $\theta_p' = 30°$, 42.5°, and 70° the correlation functions are represented fairly well by the simple Born approximation calculation, $\sin^2 2(\theta_\gamma - \theta_0)$. However, at larger angles, $\theta_p' = 95°$, 120°, and 150°, changes in the shapes of correlation curves are observed, introducing a contribution from a $\sin^2(\theta_\gamma - \theta_0')$ term. (auth)

12230

STUDY OF SOME REACTIONS OF 14.8-MEV DEUTERONS WITH THE LITHIUM ISOTOPES. E. W. Hamburger and J. R. Cameron (Univ. of Pittsburgh). Phys. Rev. 117, 781-95(1960) Feb. 1.

Metallic targets of enriched Li^6 and Li^7 were bombarded with 14.8-Mev deuterons. The outgoing particles were magnetically analyzed and detected in nuclear emulsions or scintillation counters. Angular distributions for the following reactions were measured: Li^6(d,p)Li^{7*} 4.6 and 7.46 Mev, Li^7(d,p)Li^{8*} 2.28 Mev, Li^7(d,t)Li^{6*} 3.57 Mev, Li^6(d,d′)Li^{6*} 2.19 Mev, Li^6(d,α)He^4 ground state, Li^6(d,t)Li^5 and Li^6(d,He^3)He^5. A search was made for other levels produced in these reactions and in the Li^7(d,d′)Li^{7*} reaction. No new levels were observed; upper limits on the cross sections of unobserved levels are given. The results of the (d,p), (d,t), and (d,He^3) reactions were compared with stripping theory and with the predictions of the shell model. The agreement is satisfactory. The Li^6(d,t) and Li^6(d,He^3) reactions produce a continuous spectrum of outgoing particles at each angle. The angular distribution of the tritons (or He^3 particles) is strongly peaked forward and can be fitted with Butler curves having $l = 1$, $r_0 = 6$f. The spectra at small angles show a peak corresponding to the Li^5 (or He^5) ground state, but at large angles the peak disappears and the spectra are constant. The shape of the spectra can be explained by the Butler formula if the energy dependence of the reduced width is taken into account. The form of this dependence was deduced from the results of the nucleon-helium elastic scattering experiments. (auth)

12231

EFFECT OF COMPRESSION ON THE DECAY RATE OF Tc^{99m} METAL. R. A. Porter (Univ. of California, Livermore) and W. G. McMillan (Univ. of California, Los Angeles and RAND Corp., Santa Monica, Calif.). Phys. Rev. 117, 795-800(1960) Feb. 1.

The Thomas-Fermi statistical potential was employed to obtain the initial and final state electronic wave functions for two volumes: the normal uncompressed state and the 10% compressed state. The compressibility of technetium metal was estimated to be 0.27 megabar^{-1}. From this compressibility and the assumption that the internal conversion coefficient is linear in pressure, the fractional decrease in lifetime was calculated to be 2 to 4×10^{-4} for the experimental pressure of 0.1 megabar. This result agrees well with Bainbridge's measurement, $2.3 \pm 0.5 \times 10^{-4}$. (auth)

12232

SCATTERING OF 43-Mev α PARTICLES BY NUCLEI. J. L. Yntema, B. Zeidman, and B. J. Raz (Argonne National Lab., Lemont, Ill.). Phys. Rev. 117, 801-6(1960) Feb. 1.

The differential scattering cross sections for the elastic scattering of 43-Mev α particles by Zn, Ag, Rh, and Au are obtained over the angular range from 12 to 55°. The absolute errors in the cross sections are estimated to be less than 2% over most of the angular range. The group structure in the inelastic spectrum observed with protons and deuterons is also observed with α particles. In the spectra of Ag, Rh, and Zn, one group near 2.7 Mev was observed. In Al, V, and Ni a number of groups were observed. In Au and Ta no groups could be resolved. Angular distributions were obtained for the 2.5-Mev group in Rh and Ag and the 2.8-Mev group in Zn. In the case of the 2.8-Mev group in Zn, the angular distribution shows a very marked diffraction pattern. The data were fitted with Butler's theoretical expression modified to eliminate the assumption that the scattering of 43-Mev α particles by nucleons is isotropic in the center-of-mass system. It is shown that this assumption can be easily eliminated in the formal treatment. A comparison with the angular distributions obtained for the 1.04-Mev 2^+ level in Zn with both 43-Mev α particles and 21.6-Mev deuterons indicates that l = 3 is the most plausible assignment for the 2.8-Mev group. (auth)

12233

RADIOACTIVE DECAY OF LUTETIUM 173. R. G. Wilson and M. L. Pool (Ohio State Univ., Columbus). Phys. Rev. 117, 807-10(1960) Feb. 1.

Ytterbium oxide enriched to 92.6% in the 173 mass number was irradiated with 6-Mev protons. An activity with a half-life of 625 ± 50 days was produced and its assignment to Lu^{173} confirmed by the identification of the ytterbium K x ray, gamma rays corresponding to transitions among the energy levels established in Yb^{173} by Coulomb excitation of the separated isotope, and the activities produced by the similar proton irradiations of the other enriched isotopes of ytterbium. The observed activity of Lu^{173} consists of the L and K x-rays of ytterbium and gamma rays with energies of 79 ± 1, 101 ± 1, 172 ± 2, 273 ± 2, 349 ± 4, ~450, 556 ± 4, and 630 ± 4 kev and two other gamma rays not resolved in the gamma-ray spectrum but observed in gamma-gamma coincidence measurements. These two gamma rays have energies of approximately 179 and 282 kev. Because no positron radiation exists in the activity of Lu^{173}, the mode of decay is solely by electron capture to Yb^{173}. Gamma-gamma coincidence measurements lead to the assignment of a 633-kev level with a probable spin of $\frac{5}{2}+$ and the confirmation of a 351-kev level in Yb^{173} in addition to the previously known 179.5- and 78.7-kev levels. The disintegrations of Lu^{173} to the 633-kev level are by L capture only. Branching ratios for the electron capture transitions of Lu^{173} to the levels of Yb^{173} and approximate relative probabilities for the transitions in Yb^{173} are given in a proposed energy level scheme for the decay of Lu^{173}. The choice of 9/2- for the ground-state spin of Lu^{173} is the most consistent with the proposed energy level scheme. (auth)

12234

ISOMERIC STATES OF Nd^{141} AND Sm^{143}. Ralph A. James and Carleton D. Bingham (Univ. of California, Los Angeles). Phys. Rev. 117, 810-11(1960) Feb. 1.

Two previously unreported nuclear isomers which belong to the series having 81 neutrons and even numbers of protons were found and studied. These are Nd^{141m} (half-life 63.7 seconds, gamma-ray energy 0.76 Mev) and Sm^{143m} (half-life 137 seconds, gamma-ray energy 0.68 Mev). The observed properties agree with the assignment of $h_{11/2}$ and $d_{3/2}$ to the upper and lower states, respectively, as predicted by the single particle model. (auth)

12235

NUCLEAR REACTIONS OF HIGH-ENERGY C^{12}, N^{14}, AND O^{16} WITH CARBON. Murray A. Tamers (Univ. of Texas, Austin) and Richard Wolfgang (Yale Univ., New Haven). Phys. Rev. 117, 812-17(1960) Feb. 1.

The reactions of 160-Mev O^{16}, 140-Mev N^{14}, and 120-Mev C^{12} with C^{12} to yield radioactive products were studied and the results compared with those for proton induced reactions giving formally similar compound systems. No "tail" due to knock-on cascade processes was observed with heavy ions. Yields for higher energy products, chiefly F^{18}, were much higher in the heavy ion bombardments. The contribution of various stripping processes to these yields is discussed. (auth)

12236

NUCLEAR STRUCTURE EFFECTS IN Tl^{203}. B. I. Deutch and N. Goldberg (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 117, 818-22(1960) Feb. 1.

Angular correlation measurements were made on the 404-kev and 279-kev transitions following electron capture from 52-hour Pb^{203}. The following directional correlations were measured: gamma-gamma, K conversion electron-gamma, and gamma-K conversion electron. The angular distribution of all measurements was of the form $W(\theta) = 1 + AP_2(\cos\theta)$. For the $404_\gamma - 279Ke^-$ correlation, $A = -0.052 \pm 0.015$, for the $279_\gamma - 404Ke^-$ correlation, $A = -0.036 \pm 0.010$, and for the $404_\gamma - 279_\gamma$ correlation, $A = -0.151 \pm 0.010$. No effects due to perturbations of the intermediate state were found. Using the measured 279-kev K-conversion coefficient, the 404-kev K-conversion coefficient was determined to be 0.117 ± 0.015 while the 680-kev K-conversion coefficient was determined to be 0.011 ± 0.004. From the gamma-gamma angular correlation measurement result and the mixture ratio in the 279-kev transition determined by Stelson and McGowan, the mixture ratio in the 404-kev transition was determined to be $\delta_1 = +0.043 \pm 0.010$. The Sliv value for the K-conversion coefficient for this mixture ratio is 0.147. The correlations involving conversion electrons rule out a $\frac{3}{2} \rightarrow \frac{3}{2} \rightarrow \frac{1}{2}$ transition. They indicate that the M1 particle parameter in the 404-kev transition is about twice the theoretical prediction. The particle parameters for the 279-kev transition also do not agree with the theoretical predictions. (auth)

12237

CONTINUOUS ELECTRON SPECTRUM ACCOMPANYING K CAPTURE. H. Daniel, G. Schupp, and E. N. Jensen (Iowa State Univ. of Science and Tech., Ames). Phys Rev. 117, 823-7(1960) Feb. 1.

The continuous electron spectrum accompanying K capture was observed in three different ways: by measuring coincidences between one K x ray and an electron, by measuring coincidences between two K x rays and an electron, and by measuring the single electron spectrum. Coincidences between two K x rays were also measured. The coincidence data were taken with scintillation counters while the single electron spectrum was taken with a magnetic spectrometer. The electron spectrum, including the absolute intensity, and the probability for a double hole in the K shell are both found to be in agreement with the theory of Primakoff and Porter. (auth)

12238

NUCLEAR SPIN RELAXATION AND NUCLEAR ELECTRIC DIPOLE MOMENTS. E. M. Purcell (Harvard Univ., Cambridge, Mass.). Phys. Rev. 117, 828-31(1960) Feb. 1.

Proposals that nuclear spin relaxation in an appropriate system could serve as a test for the existence of a nuclear electric dipole moment are examined. It is found that low-frequency fluctuations of the local electric field are suppressed. In particular, the necessarily negative correlation of the momentum transferred in consecutive collisions of an atom in a gas alters the spectral density of the perturbation, from that of uncorrelated pulses, by the factor $\omega^2\tau_c^2/(1 + \omega^2\tau_c^2)$, where τ_c is the mean time between collisions. At optimum density a light gas at room temperature carrying electric dipole moments of magnitude e × 10^{-14} cm should have a spin relaxation time, in the absence of competing processes, of around 10 minutes. A formula is given for the electrically induced spin relaxation rate in a crystal. In the electric coupling of the lattice vibrations with the spin the "two-phonon" or "Raman" process is absent, because of the linearity of the connection between local electric field and nuclear motion. (auth)

12239

TRITON ANGULAR DISTRIBUTIONS FROM 14.8-Mev DEUTERONS ON C^{13}. S. Mayo and A. I. Hamburger (Univ. of Pittsburgh). Phys. Rev. 117, 832-4(1960) Feb. 1.

An elemental carbon target enriched to 66% in C^{13} was bombarded with 14.8-Mev deuterons. Triton groups corresponding to the ground state, 4.43- and 7.65-Mev levels in C^{12}, were magnetically analyzed and detected with photographic plates or a scintillation counter at laboratory angles between 3 and 80 degrees. The angular distributions were found to be in good agreement with Butler pick-up theory for $l = 1$. The values of the cross sections at the peak of the angular distributions are 24.3, 9.6 and 0.36 mb/sterad, respectively. These values are accurate within ± 25%. The relative reduced widths connecting C^{13} with the ground state, 4.43- and 7.65-Mev levels of C^{12} are 1 : 0.76 : 0.039. (auth)

12240

THE DIPOLE GIANT RESONANCE IN THE HIGH ENERGY PROTON SCATTERING. Mitsuji Kawai and Tokuo Terasawa (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto) 22, 513-25(1959) Oct.

The characteristic peaks in the energy spectra of high energy (p,p′) scattering accompanied by residual excitation of 20 Mev, experimentally observed by Tyren and Maris, are analyzed in terms of the Coulomb excitation. It is shown that in the Born approximation the cross section for this process can be directly connected with the absorption cross section of electric dipole γ-rays, without referring to any special nuclear model. Using the known photonuclear cross sections, (p,p′) energy spectra are calculated and are compared with experiment. The shapes of the energy spectra are reasonably well reproduced and the absolute magnitude of the calculated cross sections are in quantitative agreement with the observed ones, the former being smaller than the latter by a factor of 2 to 4. (auth)

12241

NOTE ON THE SPIN-ORBIT COUPLING AND TENSOR FORCES. Shuji Takagi (Osaka Univ.); Wataro Watari (Osaka City Univ.); and Masaru Yasuno (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 549-65(1959) Oct.

The spin-orbit coupling in heavy nuclei is investigated on the basis of strong tensor interaction between nucleons, characteristic of the pion theory of nuclear force. It is shown that the process which includes the exchange of the incident nucleon with those of the target nucleus deformed by itself is important in the low energy region, and that this process provides the spin-orbit coupling with a correct sign and reasonable magnitude. (auth)

12242

PAIRING ENERGY FOR DEFORMED NUCLEI. Morikazu Nomoto (Niigata Univ., Japan). Progr. Theoret. Phys. (Kyoto) 22, 597-609(1959) Nov.

The pairing energy for strongly deformed nuclei is estimated by dividing the energy into two parts, one of which is the interaction energy between the nucleons forming the last pair, while the other part arises from the deformation of the nucleus. Assuming an attractive inner-nucleon force with a short range, the interaction energy in the last pair is first estimated on the Nilsson model, and is then estimated in the case where the deformation is extremely strong. The deformation energy is estimated on the unified model. The calculation is carried out for the last neutron pairs of the five nuclei Gd^{158}, Dy^{164}, Yb^{174}, Hf^{178}, and Hf^{180} in the rare earth region. The results obtained by using the Nilsson model as well as the unified model are in fairly good agreement with the experimental data. (auth)

12243

ON THE ROLES OF EFFECTIVE INTERACTIONS IN NUCLEAR COLLECTIVE MOTION. Kiyomi Ikeda, Minoru Kobayasi, Toshio Marumori, and Takanori Shiozaki (Kyoto Univ.) and Shuji Takagi (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 22, 663-80(1959) Nov.

An attempt to investigate the nuclear collective motion from the standpoint of particle excitations is outlined. In this way, it is possible to investigate the roles of the effective particle interactions in the nuclear collective motions and clarify the mechanism of the collective excitation. The idea is illustrated by taking the simplified two-dimensional harmonic oscillator shell model with the quadrupole-quadrupole effective interactions between particles. It is shown that this system successfully describes both the surface vibrational and the rotational collective motions consistently, depending upon the assumed configurations of particles in the shells. (auth)

12244

NUCLEAR MODELS. Guido Beck. Rev. fac. quím., Univ. nac. mayor San Marcos (Lima) 8, No. 2, 41-8(1956) July-Dec. (In Spanish)

As an introduction to the discussion of nuclear models, the Bohr atomic model is described. The nuclear model analogous to this atomic model is then discussed. Because of the very narrow nuclear levels found by Fermi, the compound nucleus model was then proposed. This model was limited in the region of very high and very low energies. The shell model was then proposed. The refinement of this model is briefly considered. (J.S.R.)

12245

RESONANCE ENERGIES FOR PROTON CAPTURE. II. SODIUM. S. Wagner and M. Heitzmann (Physikalisch-Technische Bundesanstalt, Brunswick). Z. Naturforsch. 15a, 74-8(1960) Jan. (In German)

In a high-voltage stabilized cascade accelerator the resonance energies were determined for the reaction $Na^{23}(p,\gamma)Mg^{24}$. The resonance energies were determined from relative measurements of the high voltage on a potentiometer which was calibrated by means of the 504.5 ± 0.3 and 506.5 ± 0.3 kev resonances of the $Al^{27}(p,\gamma)Si^{28}$ reaction. (tr-auth)

12246

RADIOACTIVE DECAY OF Ag^{110m}. N. M. Anton'eva, A. A. Bashilov, and E. K. Kulakovskii (Leningrad State Univ.). Zhur. Ekspt'. i Teoret. Fiz. 37, 1497-1505(1959) Dec. (In Russian)

A magnetic spectrometer study was made of the photoelectron spectrum produced by the γ rays of Ag^{110m} and also of the β-ray spectrum up to an energy of 530 kev and the spectrum of conversion electrons corresponding to nuclear transitions with energies of 116 and 656 kev. The internal conversion coefficients for 14 nuclear transitions in Cd^{110} and the multipolarity of the radiation were determined on basis of the relative line intensities found in the present work and the data presented in a previous paper. The decay scheme is discussed. (auth)

12247

FAST PHOTONEUTRONS FROM Be^9, C^{12} AND Al^{27}. L. A. Kul'chitskii and V. Presperin (Leningrad Inst. of Physics and Tech., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1524-9(1959) Dec. (In Russian)

An investigation was carried out of the angular distributions of photoneutrons with energies above 10 Mev emitted by Be^9, C^{12}, and Al^{27} targets under the irradiation by 88-Mev peak energy bremsstrahlung. The energy spectrum of photoneutrons emitted at an angle of 75° from C^{12} was also investigated, and from the data thus obtained a comparison is made of the photoneutron and photoproton yields in the same energy intervals. The angular distribution results are compared with the quasi-deuteron model and direct resonance nuclear photoeffect. Qualitative agreement with the quasi-deuteron model was obtained. (auth)

12248

COULOMB EXCITATION OF ODD A NUCLEI BY HEAVY IONS. D. G. Alkhazov, A. P. Grinberg, G. M. Gusinskii, K. I. Erokhina, and I. Kh. Lemberg (Leningrad Inst. of Physics and Tech., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1530-42(1959) Dec. (In Russian)

High-lying levels in some light nuclei (Al^{27}, Sc^{45}, V^{51}, and Nb^{93}) which previously could not be observed because of background when protons or α particles were used, have now been excited by using "heavy" ions as bombarding particles. It is established that some of the γ lines observed in previous investigations, in which chromium was irradiated with protons or α particles, are not due to coulomb excitation of the corresponding levels in chromium. By using ions heavier than α particles it could be verified that lines associated with nuclear levels excited previously with α particles (Rb^{87}, Sn^{117}, and Sn^{119}) are actually emitted as a result of coulomb excitation. The partial lifetimes $\tau(E2)$ of excited levels were determined for the electric quadrupole transition. The measured values of $\tau(E2)$ lie between 10^{-7} and 10^{-12} sec. (auth)

12249

EXPERIMENTS IN THE PRODUCTION OF A NEW FERMIUM ISOTOPE. V. P. Perelygin, E. D. Donets, and G. N. Flerov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1558-63(1959) Dec. (In Russian)

The α-active products of interaction between accelerated oxygen O^{16} ions and uranium U^{238} nuclei were studied. Some proof was obtained of the existence of a new fermium isotope Fm^{249} which possesses a half life of about 150 sec and an α-particle energy of (7.9 ± 0.3) Mev. Excitation curves are presented for reactions involving the emission of four and five neutrons; the oxygen ion energies lie between 84 and 98 Mev. A procedure for identification of transuranium isotopes is described which is based on the registration in photographic emulsions of their successive α decays. (auth)

12250

ELASTIC SCATTERING OF 8.7 Bev PROTONS ON PHOTOGRAPHIC EMULSION NUCLEI. B. P. Bannik, V. G. Grishin, M. Ya. Danysh, V. B. Lyubimov, and M. I. Podgoretskii (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1575-82(1959) Dec. (In Russian)

Elastic scattering of 8.7 Bev protons on photographic emulsion nuclei was studied by a special method. The measured scattering angular distribution is in good agreement with that calculated on the basis of the optical model with consideration of refraction in the nucleus. (auth)

12251

ELASTIC SCATTERING OF 390 Mev π^+ MESONS BY PROTONS. E. L. Grigor'ev and N. A. Mitin (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1583-6(1959) Dec. (In Russian)

The angular distribution of (390 ± 25) Mev π^+ mesons elastically scattered on hydrogen was measured with help of nuclear photographic emulsions. An expression for the differential scattering cross section is given. Phase shifts of the Fermi solution obtained by assuming that only S and P states participate in scattering are $\alpha_3 = -34°$, $\alpha_{33} = 151°$, and $\alpha_{31} = -16°$. (auth)

12252

ELASTIC SCATTERING OF 630 Mev NEUTRONS BY PROTONS. N. S. Amaglobeli and Yu. M. Kazarinov (Joint Inst. for Nuclear Research, Dubna, USSR and Inst. of Physics, Academy of Sciences, Georgian, SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1587-93(1959) Dec. (In Russian)

Differential elastic (n-p) scattering cross sections $\sigma_{np}(\vartheta)$ are measured in the angle range $\vartheta = 11°$ to 180° (c.m.s.) for neutrons with a mean energy of 630 Mev. Within the errors of the experiments the data thus obtained are identical to the results of measurements carried out previously with 580 Mev mean energy neutrons. The dependence $\sigma_{np}(\vartheta)$ near the angle $\vartheta = 180°$ was employed to determine the π-meson-nucleon coupling constant by Chew's method. The value $f^2 = 0.06 \pm 0.02$ was obtained in this manner. (auth)

12253

PRODUCTION OF MULTI-CHARGED PARTICLES ON PHOTOGRAPHIC EMULSION NUCLEI BY 280 Mev π^+ MESONS. N. S. Ivanova, V. I. Ostroumov, and Yu. V. Pavlov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1604-12(1959) Dec. (In Russian)

The production of fragments in nuclear disintegrations induced by 280 Mev π^+ mesons is studied by aid of photographic emulsions. The angular, charge, and energy distributions of the emitted fragments are measured. An analysis of the experimental data and comparison with the results of theoretical calculations show that in the case under consideration the particles responsible for formation of the fragments are protons produced in the absorption of π^+ mesons by quasi-deuteron pairs and also recoil nucleons produced in scattering of π mesons on separate nucleons of the nucleus. Some suggestions regarding the mechanism of formation of such fragments are made on the basis of an analysis of the energy spectra of fragments produced by particles of various energy. (auth)

12254

μ^- MESIC MOLECULAR PROCESSES IN HYDROGEN. V. B. Belyaev, S. S. Gershtein, B. N. Zakhar'ev, and S. P. Lomnev (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1652-62(1959) Dec.

A number of mesic atomic and mesic molecular processes in a medium of hydrogen isotopes (formation of mesic molecules, $H_\mu^{(1)} + H^{(2)} \rightarrow (H^{(1)}H^{(2)})_\mu$, elastic collisions and charge exchange of mesic atoms $H_\mu^{(1)} + H^{(2)} \rightarrow H_\mu^{(1)} + H^{(2)}$, $H_\mu^{(1)} + H^{(2)} \rightarrow H^{(1)} + H_\mu^{(2)}$) are considered. The levels of the mesic molecules are determined. The computations were performed on the BESM electronic machine with corrections of the order of m_μ/M considered for the motion of the nuclei. (auth)

12255

COLLISION OF NUCLEONS WITH LARGE ORBITAL MOMENTA. A. D. Galanin, A. F. Grashin, B. L. Ioffe, and I. Ya. Pomeranchuk. Zhur. Eksptl'. i Teoret. Fiz. 37, 1663-79(1959) Dec. (In Russian)

That part of the nucleon-nucleon scattering amplitude for large orbital momenta $l \gg 1$ which is due to exchange between two mesons is calculated. The connection between this amplitude and scattering of real mesons by nucleons is established with the aid of the dispersion equations. The method is valid when in addition to the condition $l \gg 1$ the inequality $l\mu/\rho \gg 1$ is also satisfied (μ is the meson mass, and ρ is the nucleon momentum in the c.m.s.). (auth)

12256

DISPERSION RELATIONS FOR SCATTERING OF γ-QUANTA ON NUCLEONS. L. I. Lapidus and Chou Kuang-chao (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1714-21(1959) Dec. (In Russian)

Dispersion relations for scattering of γ quanta by nucleons with one subtraction are considered. For forward scattering six relations were obtained which do not contain unknown constants or infrared divergences. (auth)

12257

ON THE CLUSTERING OF NUCLEONS IN LIGHT NUCLEI. V. G. Neudachin, Yu. F. Smirnov, and N. P. Yudin (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl' i Teoret. Fiz. 37, 1781-3(1959) Dec. (In Russian)

Equivalence of wave functions of the shell theory with LS coupling for states with higher symmetry of the orbital part and the antisymmetrized wave functions composed of wave functions of nucleon clusters is demonstrated by help of the theory of the permutation groups. Some simple examples are considered. (auth)

12258

INVESTIGATION OF THE $Si^{30}(p,\gamma)P^{31}$ REACTION. Adrianus Maria Hoogenboom. Thesis, Hague, State University at Utrecht, 1958. 111p.

The proton beam of a cascade generator was used to investigate the $Si^{30}(p,\gamma)P^{31}$ reaction to the maximum available energy of 800 kv. The five proton resonances in this region lead to previously known levels in P^{31}, of which spins and parities were investigated and decay schemes determined. The intensity ratio of electric quadrupole to magnetic dipole radiation was determined for a number of transitions. The radiative width, or at least a lower limit to the radiative width, was determined for those transitions originating at the resonance levels. These results were obtained using several experimental methods and by the sum-coincidence method. (Reactor Centrum Nederland).

12259

MEASUREMENTS OF SHORT AND VERY SHORT LIFETIMES OF NUCLEAR STATES. Jacob Gerard Siekman. Thesis, Groningen, Netherlands, State University, 1959. 64p.

The M-1, M-2, and E-2 transitions in Tl^{208}, Rb^{85}, Yb^{170}, Rn^{220}, and Ra^{224} were investigated. (Reactor Centrum Nederland) Groningen, State University, 1959.

12260

NUCLEAR SPECTROSCOPY. PART A. Fay Ajzenberg-Selove, ed: Pure and Applied Physics. A Series of Monographs and Textbooks. Volume 9. New York, Academic Press, 1960. 637p. $16.00.

The spectroscopy of charged particles is discussed relative to the interactions of charged particles with matter, types of charged-particle detectors, measurement of spectra, experimental methods, and radioactive decay schemes. Types of gamma reactions with matter and methods of detecting and measuring gamma spectra are discussed. Gamma decay of nuclear states and the types of neutron interactions with matter are discussed. Techniques of slow neutron spectroscopy and methods of measuring fast neutron spectra are described. The study of nuclear states by neutron spectroscopy is discussed. The spectroscopic study of photonuclear reactions and measurements of very short lifetimes and electromagnetic moments of nuclear states are considered. (C.J.G.)

12261

STRUCTURE EFFECTS IN THE INTERACTION BETWEEN NUCLEI AND ATOMIC ELECTRONS. Abraham Samuel Reiner. Thesis, Amsterdam, Municipal University, 1958. 150p.

Nuclear models are considered relative to the electromagnetic interaction between the nucleus and atomic electrons. The electron wave function in the presence of an extended nuclear charge distribution is discussed with special reference to monopole structure effects and the electric monopole transition. The structure effects in hyperfine structure and the structure effects in coefficients of internal conversion are discussed. (Reactor Centrum Nederland).

Particle Accelerators

12262 AERE-R-3097

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A METHOD OF COMPUTING MAGNETIC FIELDS AND PARTICLE ORBITS IN F.F.A.G. ACCELERATORS. R. Taylor. Dec. 1959. 15p. BIS.

An account is given of a method, which has been found convenient for use with the Mercury digital computer, of obtaining the magnetic field components as functions of position, particle orbits, and the frequencies of small-amplitude radial and vertical oscillations, in accelerators having the dynamical scaling property of F.F.A.G. fields, that orbital geometry is independent of momentum. The appendix shows how the forms of all three field components follow from this condition. (auth)

12263 CERN-60-1

European Organization for Nuclear Research, Geneva.

CONTRIBUTION A L'ETUDE DES BETATRONS A AIR. (Contribution to Studies of Air Betatrons). P. Gratreau and Ch. Maisonnier. Jan. 1960. 46p.

The advantages and disadvantages of air-core betatrons are summarized and a general study is made. The calculation of a betatron without iron amounts to a determination of a vector potential function $\vec{A}$ satisfying the equations $\Delta\vec{A} = 0$, div $\vec{A} = 0$, and such that on the equilibrium orbit of radius r_0, $\vec{A}$ reduces to its azimuthal components A_θ and A_0 which should be independent of θ and present an extremum condition. The radius of curvature R of the curve A_θ as a function of r is: R/r_0 = reciprocal of $A_0(1 - n_0)/r_0$ with $n_0 = -(r/B)(\partial B/\partial r) = r_0^2/A_0(\partial^2 A/\partial z^2)$, $r = r_0$, $z = 0$, R being alternatively + and − for an alternating gradient betatron. These equations are solved for both continuous and discontinuous current distributions. (T.R.H.)

12264 DESY-A2.55

Deutsches Elektronen-Synchrotron, Hamburg.

VORBEREITENDE UNTERSUCHUNGEN ZUR STRAHLAUSLENKUNG. TEIL I. (Preparatory Studies on Radiation Deflection. Part I). F. Brasse. Dec. 16, 1959. 44p.

The applications and importance of rapid and slow ejection of particle beams from accelerators in nuclear physics experiments are pointed out, then each type of ejection is considered separately in relation to the DESY synchrotron. The topics discussed with respect to rapid deflection are: arrangement of the deflection magnet, path and properties of the ejected beam, the rapidly pulsed magnetic field, and a survey of numerical data. For slow deflection the discussion includes: beam movement through radiation loss, distortion of equilibrium orbit, deflection by high-frequency fields, deflection magnets, and survey of numerical data. The positions of the outer electron beam, the accelerator ring, and the building for the DESY synchrotron are indicated and discussed. (T.R.H.)

12265 DESY-A2.57
Deutsches Elektronen-Synchrotron, Hamburg.
ABSCHÄTZUNG DER SCHWINGUNGSAMPLITUDEN FÜR DESY. (Estimation of the Oscillation Amplitude of DESY). H. O. Wüster. Mar. 7, 1960. 74p.

The anticipated amplitudes of radial and vertical oscillation are presented for different positions of the field period of DESY. (T.R.H.)

12266 NP-8418
Illinois. Univ., Urbana. Nuclear Radiation Lab.
STATUS REPORT ON THE MAGNETIC FIELD PROGRAM FOR THE UNIVERSITY OF ILLINOIS SPIRAL RIDGE CYCLOTRON. Technical Report No. 11. J. O. Ballance, J. L. Friedes, L. E. Ernest, and J. S. Allen. Oct. 1959. 34p. Contract Nonr-1834(05).

When measurements were analyzed, it was discovered that the magnetic field of the spiral ridge cyclotron was radically different from the expected shape. Efforts were directed toward the design of a correction coil which would correctly shape the magnetic field. Extensive measurements were made in this connection. Data from these measurements are correlated, and techniques developed for the measurements are set forth. (W.D.M.)

12267 NP-8419
Illinois. Univ., Urbana.
PRELIMINARY PROPOSAL FOR OBTAINING EMULSION IRRADIATIONS TO A 30 BEV INTERNAL PROTON BEAM. Technical Report No. 12. R. D. Hill. Feb. 8, 1960. 9p. Contract Nonr-1834(05).

The main obstacle associated with an internal beam proton irradiation of nuclear emulsions is one of reducing the intensity of protons traversing the emulsions. The possibility of using diffraction scattering in carbon rods as an attenuator is examined. The problem of the secondary pion background is considered. (W.D.M.)

12268 TID-5680
[Midwestern Universities Research Assn., Madison].
MINUTES OF THE MURA GENERAL CONFERENCE, 2203 UNIVERSITY AVENUE, MADISON, WISCONSIN, JULY 9-10, 1959. 19p. OTS.

A number of talks were presented which reviewed the work of the Summer Study Group. Brief summaries are presented on the various topics covered. (W.D.M.)

12269
STRONG FOCUSING IN A LINEAR ACCELERATOR. P. M. Zeidlits, L. I. Bolotin, E. I. Revutskii, and V. A. Suprunenko. Atomnaya Energ. 8, 127-33(1960) Feb. (In Russian)

Strong focusing in proton linear accelerators was studied, and a detailed numerical analysis was made of proton motion in the system. Engineering calculations for quadrupole lenses and experimental data on strong focusing in a 5.5-Mev proton linear accelerator are presented. (tr-auth)

12270
ON THE INJECTION OF ELECTRONS IN A BETATRON. V. P. Yashukov. Atomnaya Energ. 8, 150-1(1960) Feb. (In Russian)

The influence of the injection pulse configuration on the maximum γ radiation intensity was studied in a 100-Mev synchrotron with betatron injection. The experiments were carried out with a 2 to 10 μsec rectangular pulse generator, a sinusoidal pulse generator with pulses of 1.2 to 12 μsec at the pulse base, a generator of 2 μsec pulses with a variable front at the capture area (such a configuration is achieved by superimposing the rectangular pulse over a sinusoidal), and a generator of package pulses of nearly 8 μsec, with up to three pulses per package. All measurements were made in the synchrotron superstructure, with 30-kv injection, with a one-liter ionization chamber placed 2 m from a target acting as a transducer. With single injections the pulse configuration did not affect the maximum intensity. In all cases the maximum intensity was found at the apex of the pulse or at the front angle, the shelf of a rectangular pulse. At other pulse regions the intensity of γ radiation at injection is smaller. The maximum number of particles in the chamber per cycle was 10 to 25% of the theoretical charge maximum. The intensification of γ radiation can be achieved by bringing the number of particles per cycle closer to the theoretical maximum and by maintaining a larger number of particles on the orbits after capture. (R.V.J.)

12271
SOME DATA ABOUT DISTRIBUTION OF RADIATION FROM UNRI SYNCHROCYCLOTRON. M. M. Komochkov and V. N. Mekhedov. Atomnaya Energ. 8, 152-3(1960) Feb. (In Russian)

Neutron generation in a beryllium target by ~630 Mev proton beams with currents of 0.2 to 0.3 μa was measured with 4 detectors placed in the beam plane. An ionization chamber, recording pulses of bismuth fission fragments, was used as an $E_n > 50$ Mev detector. The recording installation was placed 10 to 14 m from the target. The data on angular distribution indicate a sharply directed cone of radiation. For $E_n > 50$ Mev, the cone has a regular, nearly symmetric configuration; the half-width of the cone is 29 ± 1°. The background of $E_n > 50$ Mev neutrons in various directions is not over 11% of the maximum flux. Special measurements established that neutrons emitted in directions opposite to the maximum flux do not originate in the target. The neutron flux emitted from the target, recorded with carbon detectors at 14 m distance, was equal to 3 to 7×10^4 n/cm^2 sec for $E_n > 20$ Mev; for $E_n > 50$ Mev, it was $\sim 4 \times 10^{10}$ n/sec; and for neutrons produced by proton scattering, it was 3×10^{10} n/sec. Measurements revealed a considerable neutron flux outside the building. In places where shielding was not over 2 m thick the neutron level was 15 to 45 n/cm^2 sec for $E_n > 50$ Mev, and 500 to 750 n/cm$^2 \cdot$ sec for $E_n > 0.5$ Mev. The flux of $E_n > 50$ Mev neutrons on the roof of the accelerator building was < 0.2 n/cm$^2 \cdot$ sec, and for $E_n > 0.5$ Mev it was 20 to 40 n/cm$^2 \cdot$ sec. The measurements confirmed the safety of the accelerator shielding. However, a more compact and more economical shielding construction is suggested for the future. (R.V.J.)

12272
MATTERS PERTAINING TO ELIMINATION OF BACKGROUND IN LOW ENERGY NUCLEAR PHYSICS MEASUREMENTS, WITH SPECIAL REFERENCE TO THE BARTOL-ONR GENERATOR. C. P. Swann, V. K. Rasmussen, and H. O. Albrecht (Bartol Research Foundation, Swarthmore, Penna.). J. Franklin Inst. 268, 226-34(1959) Sept.

A new low background target room was constructed for the Bartol-ONR Van de Graaff generator. This room is constructed of low radioactivity content concrete and serves to shield the target area from the radiation arising from the soil, the beam analyzing magnet, and the small Bartol generator. Over the energy range from 400 kev to 3 Mev, the natural radioactive background is at least a factor of 5 lower than in the original target room. The effects of neutrons from the analyzing magnets and the small machine were reduced to a negligible amount. The cost of the special concrete used in this structure was less than twice the cost of normal concrete. (auth)

12273

THE OAK RIDGE RELATIVISTIC ISOCHRONOUS CYCLOTRON. PART III. ANALYSIS OF ION ORBITS IN THE ISOCHRONOUS CYCLOTRON. M. M. Gordon and T. A. Welton (Oak Ridge National Lab., Tenn.). Nuclear Instr. and Methods 6, 221-33(1960) Feb. (In English)

Calculations of radial and axial beam stability limits in three- and four-sector azimuthally varying magnetic fields are reviewed. The use of the radial instability at $\nu_r = 1$ to provide a resonance method of beam deflection is discussed. (auth)

12274

THE OAK RIDGE RELATIVISTIC ISOCHRONOUS CYCLOTRON. ADDENDUM, SOME RECENT RESULTS OF ORBIT STUDIES. R. H. Bassel and R. S. Bender (Oak Ridge National Lab., Tenn.). Nuclear Instr. and Methods 6, 234-7 (1960) Feb. (In English)

Analytic expressions for the focusing frequencies and other parameters of orbit motion were derived for the relativistic isochronous cyclotron. (auth)

12275

TECHNIQUES OF CHEMICAL RESEARCH WITH THE ELECTRON VAN DE GRAAFF. C. D. Wagner, V. A. Campanile, and V. P. Guinn (Shell Development Co., Emeryville, Calif.). Nuclear Instr. and Methods 6, 238-42 (1960) Feb. (In English)

Modifications to a 3 Mev electron Van de Graaff to be used in research and development of radiation-stable petroleum products, organic chemistry, and neutron activation analysis are described. (C.J.G.)

12276

QUADRUPOLE MAGNETIC LENSES. [PART] II. Pierre Grivet and Albert Septier (Faculté des Sciences, Paris). Nuclear Instr. and Methods 6, 243-75(1960) Feb. (In French)

The optical properties of quadrupole lenses are discussed and the results of magnetic measurements of the field configuration in the spaces crossed by the particles are given. A method of direct study of optical properties and of aberrations in a system of two crossed lenses by means of a special ionic-optical bench are described. It is shown that the aperture defect can be corrected in this type of lens, by correcting the profile of the polar pieces. The calculation of the aperture defects by different methods is demonstrated. After giving the equations of motion to the third order. a method of calculation which is based on representing the characteristic function of the lens by a rectangular model is presented. The results of calculations made by different electronic machines are compared. Agreement between experimental and calculated results was obtained. (auth)

12277

IRRADIATION OF METALS AT CONTROLLED ELEVATED TEMPERATURES IN THE M.I.T. CYCLOTRON. C. E. Ells (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nuclear Instr. and Methods 6, 276-8(1960) Feb. (In English)

The construction and performance of a specimen holder for metals which are to be subjected to irradiation tests at temperatures up to 750°C in a cyclotron are discussed. (C.J.G.)

12278

CALCULATION OF THE ION OPTICAL PROPERTIES OF INHOMOGENEOUS MAGNETIC SECTOR FIELDS: NOTE ON THE TRAJECTORIES OUTSIDE THE MEDIAN PLANE WITH OBLIQUE INCIDENCE, AND ON THE SECOND ORDER ANGULAR ABERRATION COEFFICIENT. H. A. Tasman and A. J. H. Boerboom (Laboratorium voor Massaspectrografie, Amsterdam) and H. Wachsmuth (Technische Hoschshule, Munich). Z. Naturforsch. 15a, 78-9(1960) Jan. (In English)

The expression for second order aberrations outside the median plane, previously reported in Z. Naturforsch. 14a, 816(1959), are modified to take into account the first order influence of the stray fields with oblique incidence. The expression for the coefficient A_{11} of the second order angular aberration is given for the symmetrical case with oblique boundaries (either plane or curved). (J.S.R.)

Plasma Physics and Thermonuclear Processes

12279 AD-159527

Avco Mfg. Corp. Avco Research Lab., Everett, Mass.
ONE DIMENSIONAL FLOW OF AN IONIZED GAS THROUGH A MAGNETIC FIELD. Research Report 13. R. M. Patrick and T. R. Brogan. Oct. 1957. 53p. Contract AF04(645)-18.

The flow of a partially ionized gas in a magnetic field was studied, both theoretically and experimentally, in the case where the gas flow is one dimensional. This simplification permits detailed calculation of the results to be expected, and quantitative comparison with experiment utilizing a shock tube to provide the ionized gas. An ionized gas is composed of three species, electrons, ions, and neutral particles. To take complete account of all the phenomena occurring when the high velocity gas interacts with the magnetic field, the motion of all three species must be considered. When this is done, it is found that the electrical conductivity of the gas is a tensor dependent on both the magnitude and geometry of the magnetic field. However, when the collision frequency for the electrons is greater than their cyclotron frequency in a magnetic field, the gas may be considered a continuum with a scalar conductivity. When the gas state is adjusted to produce a scalar conductivity, all of the observed effects can be explained with a simple theory for two experimental geometries in which the gas current forms closed loops in the magnetic field. The interaction produces a flow completely analogous to pipe flow with friction and no heat transfer, where the wall friction force is replaced by the magnetic body force which chokes the flow and forces sonic speed at the exit of the field. Using the same experimental geometries, the gas state is then adjusted so that the electrical conductivity is a tensor. Outstanding among the observed effects are ion slip, where the ions and neutrals travel through the field at different velocities, and Hall currents, generated by the drift of the charged particles across magnetic field lines. The observed effects again agree with the predicted values. (auth)

12280 AFCRC-TR-59-174

Air Force Cambridge Research Center. Electronic Material Sciences Lab., Bedford, Mass.
A SURVEY OF THE RESEARCH OF IONIZED MEDIA.

E. Atlee Jackson. May 29, 1959. 32p. Project 5634. (AD-228696).

The literature which sheds light on either the dynamical or equilibrium properties of ionized media is surveyed. The survey is arranged in chronological order to the extent that this does not conflict with the conceptual development of the subject. Brief discussions are given of the research attempt to point out some of the areas of controversy, incompleteness, and errors. (W.D.M.)

12281 AFOSR-TN-58-215
Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
CYLINDRICAL SHOCK WAVES PRODUCED BY INSTANTANEOUS ENERGY RELEASE IN MAGNETO-GAS DYNAMICS. S. I. Pai. Feb. 1958. 30p. Contract AF-18(600)-993. (BN-120; AD-154116).

The behavior of a cylindrical shock wave produced by instantaneous energy release along a straight line of infinite extent in a conducting gas subjected to a magnetic field with circular lines of force was analyzed. Numerical examples are given for constant initial density. (W.D.M.)

12282 AFOSR-TR-59-125
Johns Hopkins Univ., Baltimore. Dept. of Aeronautics.
PLASMA DYNAMICS. Francis H. Clauser. Aug. 1959. 80p. Contract AF18(600)-671. (AD-229510).

The one-dimensional, steady-state flow of a gas consisting of particles all having the same electrical charge is explored. The question of what dynamical equations govern such a flow is discussed. These equations are solved without sacrificing their nonlinear character. The full range of behavior from zero Mach number to infinite Mach number is explored as is the full range of the effect of external electric fields on the flow. Results show that the non-linearity of the equations introduces several fundamental new concepts to fluid mechanics. Under some conditions a number of radically different flows can exist for exactly the same set of boundary conditions. Under other conditions, no flows whatever exist that fit the boundary conditions. (auth)

12283 ARL-57-1012
Ramo-Wooldridge Corp. Aeronautical Research Lab., Los Angeles.
ON THE INTERPENETRATION OF A PLASMA AND ITS CONFINING ELECTROMAGNETIC WAVE FIELD. Erich S. Weibel. May 6, 1957. 28p.

Issued under Space Technology Labs., Inc. Physical Research Lab. Cover.

The possibility of confining a plasma with a standing electromagnetic wave is considered. Equations are derived which determine the distribution of the plasma and the field intensities. A solution of the problem is given only for the unreal case in which the masses of the positive and negative particles are the same. (W.D.M.)

12284 CEA-1199
France. Commissariat à l'Énergie Atomique, Paris.
MESURE DE TEMPÉRATURES DANS LES PLASMAS THERMONUCLÉAIRES. (Temperature Measurement in Thermonuclear Plasmas). Denis Breton. 1958. 22p.

Thesis submitted to the Univ. of Paris.

The temperatures needed to produce thermonuclear reactions are of the order of several million degrees Kelvin. Devising methods for measuring such temperatures has been the subject of research in many countries. In order to present the problem clearly and to demonstrate its importance, the various conditions which must be fulfilled in order that reactions may be qualified as thermonuclear are reviewed. The relationship between the temperature and the cross-section of the reactions is studied, and it is shown that the notion of temperature in the plasmas is complex, which leads to a consideration of the temperature of the ions and that of the electrons. None of the methods for the temperature measurements is completely satisfactory because of the hypotheses which must be made, and which are seldom fulfilled during high-intensity discharges in the plasmas. In practice it is necessary to use several methods simultaneously. (auth)

12285 NP-8432
Space Technology Labs., Inc. Physical Research Lab., Los Angeles.
RADIATION BY PLASMA OSCILLATIONS IN A BOUNDED PLASMA IN A MAGNETIC FIELD. H. W. Wyld, Jr. Oct. 23, 1959. 28p. (PRL-9-23).

The radiation by a thermal distribution of plasma oscillations in a bounded plasma in a magnetic field is calculated in the limit $(\omega_c/\omega_p)^{1/3} \ll 1$, where ω_c and ω_p are the cyclotron and plasma frequencies. The calculation is performed in two ways leading to the same result: (1) a "Fresnel formula" for the ratio of the intensity of the electromagnetic wave transmitted through the plasma boundary to the intensity of an incident plasma oscillation is derived; (2) the decaying modes, satisfying a radiation condition at infinity, of a bounded plasma in a magnetic field are found. The results are compared with the synchrotron radiation by a plasma in a magnetic field. It is found that for a thermal distribution of plasma oscillations the radiation due to plasma oscillations is small compared to the synchrotron radiation. (auth)

12286 NP-8433
Space Technology Labs., Inc. Physical Research Lab., Los Angeles.
THE SUPERFAST PINCH EXPERIMENT. Vernal Josephson. Nov. 2, 1959. 29p. Contract AF04(647)-309. (TR-59-0000-09880).

An assembly designed to accelerate deuterons to ~10 kev by means of a radially converging magnetic piston was constructed and tested. The design features and operational problems encountered in the construction are discussed. Samples of experimental data are included to illustrate the assembly's behavior. The assembly operates with 300 kv on the condenser, the ringing frequency is 18 mc, and present operation uses hydrogen gas at 50 μ. Both slow and fast pinches are observed, the former being possibly thermal shock waves, and the latter being associated with inward motion of the plasma sheath. (auth)

12287 NP-8435
Space Technology Labs., Inc. Physical Research Lab., Los Angeles.
A STUDY OF PLASMA STABILITY IN MICROWAVE CAVITIES BY A FREQUENCY-SHIFT ANALOG. Robert A. Swanson. [1957]. 15p. Contract AF-04(647)-309. (TR-59-0000-00812).

An equation is derived which relates the pressure change at a perturbed microwave cavity boundary to the change in resonant frequency of the cavity. The equation is used to investigate the stability of a plasma confined by microwave fields. (auth)

12288 R59SD314
General Electric Co. Missile and Space Vehicle Dept., Philadelphia.
MEASUREMENTS OF VELOCITY AND MOMENTUM WITH A PULSED T-TUBE PLASMA GENERATOR. Aerophysics Research Memorandum No. 26. B. Gorowitz and B. Harned. Feb. 20, 1959. 35p. Contract AF04(647)-269.

In preliminary studies concerning the use of plasma acceleration for propulsion purposes, a series of measurements was made of velocity and momentum of plasma bursts both in single-shot and pulsed operation over a range of pressures and input energies for various magnitudes and directions of magnetic field at the gaseous discharge. The effect of magnetic field on acceleration of the plasma and its contribution to the momentum transferred to a ballistic pendulum are discussed. Extrapolation was made of power input for the small thrust obtained to that required for a one pound thrust over the range of pressures and efficiencies investigated. (auth)

12289 NYO-2882
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
THE HYDROMAGNETIC STABILITY OF A TOROIDAL GAS DISCHARGE. R. Lüst, R. D. Richtmyer, A. Rotenberg, B. R. Suydam, and D. Levy. Feb. 1, 1960. 33p. Contract AT(30-1)-1480. OTS.

The stability of a toroidal gas discharge is examined by using an energy principle. In the equilibrium configuration the plasma is assumed to be perfectly conducting and to have constant pressure and density. It is found that the pinch can be stabilized under certain very restricted conditions. However, one of the conditions is that the aspect ratio be small so that a long thin torus will always be unstable in the limit. (auth)

12290 USCEC-56-210
University of Southern California, Los Angeles. Engineering Center.
TRANSPORT PHENOMENA OF A RAREFIED AND FULLY IONIZED GAS IN THE PRESENCE OF A STRONG MAGNETIC FIELD. PART II. Toyoki Koga. Feb. 12, 1960. 19p. Contract AF18(603)-95. (AFOSR-TN-60-103).

A generalization of the theory published in USCEC-56-209, entitled Diffusion of a Fully Ionized Gas Confined in a Strong Magnetic Field, is presented. In USCEC-56-209, the number of significant moments or macroscopic variables was limited by assuming that the macroscopic variables of the first approximation, except for the number densities and the velocities of mass motion, were constant, and by also assuming that the magnetic field was homogeneous and there was no electric field. In this investigation the moments are defined in general and the results are given in terms of these moments. The effects of drifts of particles caused by the spatial homogeneity of a magnetic field and/or by an electrostatic field accompanying a uniform magnetic field were also considered. (W.L.H.)

12291 UTIA-49
Toronto. Univ.
THE INTERACTION OF A PLANE STRONG SHOCK WAVE WITH A STEADY MAGNETIC FIELD. J. H. deLeeuw. Mar. 1958. 90p. (AD-162003).

An investigation was made of the interaction of a magnetic field and the flow of ionized and electrically conductive argon. The following three configurations are considered: (1) a magnetic field transverse to the axis of either a rectangular or a circular shock tube; (2) an axially symmetric magnetic field as produced by a coil concentric with a circular shock tube; and (3) a radial magnetic field in an annular shock tube. The shock tube walls are assumed to be non-conductive. The axial components of the ponderomotive forces that act on the gas as a result of its motion through the magnetic field are calculated for each of the three cases. The analysis is based on the assumption of a weakly conductive gas. The results show that the distribution of the axial ponderomotive forces over the tube cross section is basically non-uniform for the cases (1) and (2), whereas the uniformity is reasonably good for an annular tube with typical geometry. The behavior of the flow of an ionized gas under the action of the axial ponderomotive force components was determined by considering the flow to be one-dimensional. The results indicate that the use of ideal gas flow equations is inadequate to give a correct picture of the flow of a gas with equilibrium ionization. The limiting conditions beyond which a shock wave cannot be reflected off the magnetic field are considered and the results of calculations to determine the choking conditions in the flow of an ionized gas are presented. The results for the limiting conditions for the occurrence of a reflected shock wave, which were evaluated for a couple of typical cases, show that: (1) at a given experimental pressure level a reflected shock wave is not expected to occur both for very low and very high shock Mach numbers; and (2) at a given shock Mach number the reflected shock wave is not expected to occur above a certain pressure level. Comparative calculations for neon indicate that for this gas at a given pressure level and shock Mach number, the reflected shock wave will occur at lower magnetic field strengths than would be required to produce reflected shock waves in argon. (auth)

12292 NP-tr-355
APPLIED MAGNETIC HYDRODYNAMICS. Translated from Transactions of the Inst. of Physics, Academy of Sciences, Latvian S.S.R., Riga, 1956. 142p. OTS.

The papers included in this volume are: magnetic hydrodynamic phenomena in liquid metals; electromagnetic pumps for liquid metals; theory of induction pumps; velocity distribution and magnetic hydraulic pressure losses in a rectangular channel; electromagnetic processes in induction pumps for liquid metal; edge effects in linear induction pumps; calculation of induction pumps for liquid metals; single phase alternating current pumps; and conducting sphere in a moving magnetic field. (W.L.H.)

12293
HIGH-TEMPERATURE PLASMA RESEARCH AND CONTROLLED FUSION. R. F. Post (Univ. of California, Livermore). Ann. Rev. Nuclear Sci. 9, 367-436(1959).

The mechanisms of particulate processes in a high-temperature plasma such as ionization, coulomb collisions, bremsstrahlung, excitation radiation, charge exchange, and nuclear reactions are described. The equations of motion and the pressure balance macroscopic equations for describing the collective phenomena (shocks, turbulence, or other instabilities of flow) are discussed. The physical laws governing the diffusion of a plasma across a magnetic field are examined. The characteristics of waves and oscillations in a plasma are described. Mechanisms of plasma instabilities are discussed. The pinch effect and types of magnetic bottles such as the stellarator, mirror machine, and astron are described. The problem of creating or capturing the charged particles of the plasma within a magnetic bottle is discussed. (C.J.G.)

12294
ON THE STABILITY OF PLASMA BUNCHES IN A WAVEGUIDE. M. L. Levin. Atomnaya Energ. 8, 134-5(1960) Feb. (In Russian)

The stability of plasma bunches in an accelerating waveguide was studied. Deformations in an ideally conducting plasma bunch in a quasi-stationary, homogeneous magnetic field were investigated with plasma bunches smaller than the length of the wave. (R.V.J.)

12295
AUTOMODEL SOLUTIONS TO PLASMA EQUATIONS.

B. N. Kozlov. Atomnaya Energ. 8, 135-7(1960) Feb. (In Russian)

A mathematical analysis is made of electromagnetic containment of ionized, singly charged plasma in the case where the field is concentrated in a thin layer on the plasma surface; the thickness of the layer is considerably smaller than the radius of the pinch. (R.V.J.)

12296

THEORY OF ELECTRIC CHARGE IN A CONDUCTING MEDIUM. V. N. Zhigulev (Zhukovskiĭ Central Inst. of Aerohydrodynamics). Doklady Akad. Nauk S.S.S.R. 130, 280-3 (1960) Jan. 11. (In Russian)

The theory of electric discharge in a medium with finite conductivity was analyzed, and it is shown that axially symmetric discharge is followed by a movement of the medium which produces an ejecting effect. The principle of congruency was developed for axially symmetric discharge, and auto model solutions for its equations were derived. (R.V.J.)

12297

ON THE FLAT FLOW OF AN INFINITELY CONDUCTING FLUID WHEN THE MAGNETIC FIELD AND VELOCITY VECTORS ARE ALMOST PARALLEL. M. N. Kogan. Doklady Akad. Nauk S.S.S.R. 130, 284-6(1960) Jan. 11. (In Russian)

An analysis was made of laminar flow in ideal, infinitely conducting, noncompressed fluids with almost parallel vectors of magnetic field and velocity. (R.V.J.)

12298

ON THE CONVECTIVE INSTABILITY OF THE PLASMA. Yu. A. Tserkovnikov. Doklady Akad. Nauk S.S.S.R. 130, 295-8(1960) Jan. 11. (In Russian)

Simple hydrodynamic equations are applied in the analysis of convective instability of plasma (the instability is induced by the spatial heterogeneity of characteristic parameters). The analysis is limited to small-scale perturbations without considerations for boundary conditions. A simple case of infinitely conducting fluid described by magnetohydrodynamic equations is analyzed, followed by more complex two-component systems in adiabatic approximation (with and without consideration of thermal flux). (R.V.J.)

12299

ON THE THEORY OF ELECTRONIC PLASMA IN A MAGNETIC FIELD. V. L. Bonch-Bruevich and A. G. Mironov (Moscow State Univ.). Fiz. Tverdogo Tela 2, 489-98(1960) Mar. (In Russian)

The behavior of non-degenerate electron plasma in a magnetic field was investigated by means of Green's functions. Plasma oscillation spectra were developed and the finite wave oscillation number was determined. The damping coefficient was calculated considering quantum corrections, and the screening law for external electric fields (in presence of magnetic fields) was studied. (R.V.J.)

12300

COLLISION DAMPING OF SPACE-CHARGE WAVES IN A PLASMA. S. V. Yadavalli (Stanford Research Inst., Menlo Park, Calif.). J. Electronics and Control (1) 7, 261-7 (1959) Sept. (In English)

The general determinental equation applicable to the propagation of space-charge waves including the effect of collisions (in the absence of a velocity distribution) in a plasma is derived. Solutions of the equation under different conditions suggest a possible method of noise reduction in beam type tubes, and a possible procedure for the determination of collision frequency and particle density in a plasma as typically found in some experiments on fusion research. (auth)

12301

ION REFLECTION IN ROTATING PLASMA. J. Kistemaker. Ned. Tijdschr. Natuurk. 25, 185-202(1959). (In Dutch)

The heating of a plasma, reducing radiation losses, and confinement of the plasma are discussed. The DCX- and OGRA-projects are discussed. (Reactor Centrum Nederland).

12302

INCREASING OF LONGITUDINAL WAVES PROPAGATING IN PLASMA. G. F. Filimonov. Radiotekh. i Elektron. 4, 75-87(1959) Jan. (In Russian)

A solution was derived for Vlasov's single-dimension, linearized kinetic equation describing the propagation of high-frequency signals induced by a given external force. Studies were made of a π shaped flux with Maxwellian electron velocity distribution in an undisturbed state. It was found that at low electron gas temperature, it is possible to apply the standard single-dimension approximation. An analysis of approximate expressions established the direction of proper wave propagation in plasma and resolved the problem on the existence of increasing waves in rectalinear electron flux. (tr-auth)

12303

SONDE METHODS. APPLICATION FOR CHARGE CONCENTRATION MEASURING IN A HIGH-FREQUENCY DISCHARGE. S. M. Levitskiĭ and I. P. Shashurin (Shevchenko Kiev State Univ.). Radiotekh. i Elektron. 4, 1238-43(1959) Aug. (In Russian)

An investigation showed that the classical single-probe method is effective for measuring charge concentrations in high-frequency discharge plasma. The double-probe method showed certain distortions which could not be eliminated and is recommended only for high-frequency discharge where single-probe measurements cannot be used. All the difficulties encountered with the probe methods (the effects of parasitic volume and insufficient probe blocking) were of "schematic" character. (R.V.J.)

12304

APPLICATION OF HIGH-FREQUENCY ELECTROMAGNETIC FIELDS FOR PLASMA INVESTIGATION. S. Brown. Radiotekh. i Elektron. 4, 1244-52(1959) Aug. (In Russian)

A review is presented of various methods developed in the USA for measuring electron density, electron-atom cross sections, electron-ion and ion-atom interactions, electron temperature, electron collision energy losses, and the rate of electron loss in diffusion and recombination in plasma. (R.V.J.)

12305

PECULIARITIES OF A DISCHARGE WITH THE OSCILLATION OF ELECTRONS IN A MAGNETIC FIELD. E. T. Kucherenko and O. K. Nazarenko. Radiotekh. i Electron. 4, 1253-6(1959) Aug. (In Russian)

Two types of discharge were observed with magnetic field variations. One appears in hydrogen at $P < 2 \times 10^{-3}$ mm mercury and retains its peculiarities with field variations of several tens of gauss. The second is the arc-type discharge which appears at $P > 2 \times 10^{-3}$ mm mercury and is present with magnetic field variations of several hundreds to a thousand gauss. (tr-auth)

12306

DISCHARGE IGNITION IN NON-UNIFORM FIELDS AT

LOW GAS PRESSURE. L. G. Guseva (Lenin All-Union Electrotechnical Inst.). Radiotekh. i Elektron. 4, 1260-6 (1959) Aug. (In Russian)

It was found that at the left branch of Paschen's curve the discharge ignition in heterogeneous fields varies with the alternating polarity of the electrodes. In general cases the ignition intensity is higher than the intensities corresponding by longer field lines between electrodes. (R.V.J.)

12307

THE INFLUENCE OF THE MAGNETIC FIELD UPON ION DIFFUSION IN A STATIONARY HELIUM PLASMA. I. A. Vasilieva and V. L. Granovskii. Radiotekh. i Elektron. 4, 2051-60(1959) Dec. (In Russian)

The effects of a magnetic field on ion losses from the stationary positive column in He at 0.034 to 1.1 mm mercury pressure, 0.03 to 1 amp current, with electron and ion concentrations of 10^8 to 10^{10} cm^{-3} and magnetic fields up to 2600 gauss were measured by a probe method. The measurements indicate that with magnetic field magnitudes as a function of gas pressure and current, carrier losses to the walls vary inversely with the magnetic field. The diffusion coefficient decreases with the increase of B according to the Townsend law. The diffusion of ions is ambipolar in character. (R.V.J.)

12308

COOPERATIVE PHENOMENON AND DIFFUSION OF A PLASMA ACROSS A MAGNETIC FIELD. [PART] I. L. Biermann and D. Pfirsch (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 15a, 10-12(1960) Jan. (In German)

The possibility is discussed and general arguments are given that, under certain conditions, local fluctuations of charge density may be excited in inhomogeneous plasmas. Their maximum amplitudes are estimated, and the influence of these instabilities on the confinement of plasmas by magnetic fields is investigated. (auth)

12309

THE OBSERVATION OF OVERTHERMAL ELECTRICAL FIELD FLUCTUATIONS IN PLASMAS BY MEANS OF SPECTROSCOPIC MEASUREMENTS. H. Wulff (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 15a, 13(1960) Jan. (In German)

The possibility of detecting overthermal electric field fluctuations in plasmas by Stark-effect broadening is discussed. The result is that in conventional plasmas the influence of these fluctuations is much too small to be detectable by this effect. (auth)

12310

COOPERATIVE PHENOMENON AND DIFFUSION OF A PLASMA ACROSS A MAGNETIC FIELD. [PART] II. D. Pfirsch and L. Biermann (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 15a, 14-18(1960) Jan. (In German)

By means of two examples of inhomogeneous plasmas the occurrence of microscopic instabilities is investigated. It is shown that an inhomogeneous one-component plasma with diffusion but without a magnetic field is stable in the limiting case of linearized theory and that in a similar plasma without diffusion, which is confined by a magnetic field, an instability of apparently fairly general character exists, but its range is not yet known. (auth)

12311

STABILITY OF A LOW PRESSURE PLASMA. B. B. Kadomtsev. Zhur. Eksptl'. i Teoret. Fiz. 37, 1646-51 (1959) Dec. (In Russian)

A local stability condition for an arbitrary toroidal system is derived. The problem of stability of a low pressure plasma in such systems is discussed. (auth)

12312

OSCILLATIONS OF AN ELECTRON-ION PLASMA. L. M. Kovrizhnykh (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz. 37, 1692-6(1959) Dec. (In Russian)

The spectrum of longitudinal oscillations of an electron-ion plasma is considered for the case of high temperatures (Maxwell distribution) and low temperatures (Fermi distribution). It is shown that for small values of the wave vector k the dispersion equation yields two branches which differ in their properties: an optical one for which the ion motion is not important and an acoustical one. For large values of k, only the acoustic branch remains, its properties being determined by the parameters of the ion component of the plasma. (auth)

12313

STABILITY OF A PLANE POISEUILLE FLOW OF A FINITE CONDUCTIVITY PLASMA IN A MAGNETIC FIELD. Yu. A. Tarasov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1708-13 (1959) Dec. (In Russian)

The flow stability of a longitudinal plasma in a magnetic field with respect to infinitely small perturbations is considered for Reynolds numbers $R_m \lesssim 1$. (auth)

12314

THE PLASMA JET AS AN ELECTRIC PROPULSION SYSTEM FOR SPACE APPLICATION. Gerhard Heller (Redstone Arsenal, Ala.). Presented at the ARS 14th Annual Meeting, November 16-20, 1959, Washington, D. C.). New York, American Rocket Society, 1959. 25p.

The advantages of electric propulsion systems for space navigation are discussed. The plasma jet is shown to be suited for missions between the earth and the moon. A supply mission is described between a 500-kilometer orbit and a manned space station outside the Van Allen belts at 6.6 earth radii. The mission includes the delivery of a cargo of 40,000 pounds in the upper orbit. A tilting of the orbital plane by 28° is part of the flight plan. The plasma jet used as a propulsion system has a thrust of 70 pounds and a specific impulse of 1000 seconds. A period of 17 days is required for the trip from the 500-kilometer orbit to the space station; the return trip takes 5 days. The plasma jet as a propulsion system for space vehicles can be used for transfer between orbits, change of orbit plane by tilting and precession, position control of satellites, attitude control, and "high thrust" maneuvers for planetary missions with an ion drive as main propulsion system. (auth)

12315

NUCLEAR FUSION. William P. Allis, ed. The Second Geneva Series on the Peaceful Uses of Atomic Energy. Princeton, N. J., D. Van Nostrand Company, Inc., 1960. 495p. $12.50.

Papers presented at the 1955 Conference on the Peaceful Uses of Atomic Energy which relate to fusion are presented. The topics pertaining to plasma include: diagnostics, interaction with electromagnetic waves, equilibrium and stability, and dynamics. Papers presented on mirror machines, stellarators, and injection machines are contained. The topics of ring discharges and sustained and dynamic pinches are considered. Reviews of controlled thermonuclear research in the United Kingdom, Russia, and the United States up to mid-1958 are presented. (C.J.G.)

12316

IMPROVEMENTS IN OR RELATING TO THERMONUCLEAR REACTORS. John Edward Allen and Roy John

Bickerton (to United Kingdom Atomic Energy Authority). British Patent 832,270. Apr. 6, 1960.

A toroid-type gas-discharge nuclear reactor improvement is described in which an outer toroidal winding is divided into electrically insulated sectors. Each sector is fed from a separate charged transmission line with impedance matched to the rate of change of inductance of the discharge. The transmission line forms part of a Blumlein circuit. The transmission lines provide pulsed input for their sector. (T.R.H.)

Shielding Calculations

12317 NP-8509
Florida. Univ., Gainesville.
GAMMA RAY SCATTERING. Quarterly Technical Progress Report No. 1 for January 18, 1959 through March 18, 1959. John A. Wethington, Jr., W. L. Workman, H. L. Sahlin, K. R. Rao, and R. A. Karam. 10p. Contract NOas 59-6013-c.

A program to determine the method of gamma penetration through heterogeneous shields and the penetration of photons from oblique plane sources is discussed briefly. Sources of radiation are considered and work on source holders is summarized. (W.D.M.)

12318

HEAVY CONCRETES WITH BARYTE AND IRON ORE BASE. F. Dubois. Bull. inform. sci. et tech. (Paris) No. 36, 2-24(1960) Jan. (In French)

The development of nuclear energy has led to the increasing importance of shielding against radiation. Concrete has been considered one of the best materials. However, the density of ordinary concrete is often insufficient. The use of high-density concrete as radiation shielding is discussed. The characteristics of shielding concretes are tabulated with a description of baryte concretes with iron scraps incorporated and of iron ore concretes. The biological shielding of Saturn and of very hot cells is discussed as two examples of the utilization of heavy concretes. (J.S.R.)

12319

THE DECAY OF A THERMALIZED NEUTRON PULSE. Mark Nelkin (General Atomics Div., General Dynamics Corp., San Diego, Calif.). Nuclear Sci. and Eng. 7, 210-16(1960) Mar.

A theoretical basis is presented for the interpretation of the pulsed-neutron technique for measuring thermal-neutron absorption cross sections and transport parameters. A procedure is given for the exact solution of the Fourier-transformed, multivelocity transport equation in an infinite medium. The method used is an expansion of the decay constant and neutron spectrum in a power series in the Fourier-transform variable. The procedure is first illustrated for the case of isotropic scattering and then generalized to anisotropic scattering by using the spherical harmonics expansion. The results are given in terms of integral equations whose solution involves a knowledge of the energy-transfer cross sections between thermal neutrons and the moderating material. The approach employed is to extract the maximum amount of information which is independent of these cross sections and to derive explicitly the equations involving them. The relation of the infinite medium Fourier transform variable to the geometric buckling of a finite sample is discussed. The validity of the interpretation of the experiments in terms of the diffusion coefficient and diffusion cooling coefficient by requiring the assignment of an equivalent infinite medium buckling to each finite sample measured is discussed. (auth)

Theoretical Physics

12320 AFOSR-TN-59-437
California. Univ., Berkeley.
CONSTRUCTION OF THE PERTURBATION SERIES FOR TRANSITION AMPLITUDES FROM THEIR ANALYTICITY AND UNITARITY PROPERTIES. Stanley Mandelstam. [1959]. 43p. Contract AF49(638)-327. (AD-214799).

The analyticity properties of transition amplitudes are used in conjunction with the unitarity requirements to generate successive terms in the perturbation series, without referring to a specific Lagrangian. In the sixth and higher orders, production is neglected in the unitarity condition; subject to this approximation, it is found that the series can be so constructed. No analyticity properties which have not been rigorously proved need be employed, and the terms are found to satisfy the double dispersion representation. By examining the connection between this method and the conventional calculation of the perturbation series the types of spectral function corresponding to different Feynman diagrams can be found. Formulae are given for the regions in which the spectral functions are non-zero. (auth)

12321

QUASI-PARTICLES AND GAUGE INVARIANCE IN THE THEORY OF SUPERCONDUCTIVITY. Yoichiro Nambu (Univ. of Chicago). Phys. Rev. 117, 648-63(1960) Feb. 1.

Ideas and techniques known in quantum electrodynamics have been applied to the Bardeen-Cooper-Schrieffer theory of superconductivity. In an approximation which corresponds to a generalization of the Hartree-Fock fields, one can write down an integral equation defining the self-energy of an electron in an electron gas with phonon and Coulomb interaction. The form of the equation implies the existence of a particular solution which does not follow from perturbation theory, and which leads to the energy gap equation and the quasi-particle picture analogous to Bogoliubov's. The gauge invariance, to the first order in the external electromagnetic field, can be maintained in the quasi-particle picture by taking into account a certain class of corrections to the charge-current operator due to the phonon and Coulomb interaction. In fact, generalized forms of the Ward identity are obtained between certain vertex parts and the self-energy. The Meissner effect calculation is thus rendered strictly gauge invariant, but essentially keeping the BCS result unaltered for transverse fields. It is shown also that the integral equation for vertex parts allows homogeneous solutions which describe collective excitations of quasi-particle pairs, and the nature and effects of such collective states are discussed. (auth)

12322

ON THE TWO-CHARGE RENORMALIZATION GROUP IN SCALAR QUANTUM ELECTRODYNAMICS. V. A. Shakhbazyan (Inst. of Mathematics, Academy of Sciences, USSR). Zhur. Ekspt'. i Teoret. Fiz. 37, 1789-93(1959) Dec.

The behavior in the high momentum region of single-particle Green's functions and of some asymptotic values of the vertex part and four-vertex diagram in the quantum electrodynamics of zero spin particles is investigated by the renormalization group procedure. (auth)

REACTOR TECHNOLOGY

General and Miscellaneous

12323 AAEC/E-34
Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
STUDIES OF SMALL PARTICLE SUSPENSIONS FOR L.M.F.R. PART V. THE EFFECTS OF CONCENTRATION, PIPE DIAMETER AND SOLID DENSITY ON THE HORIZONTAL SETTLING VELOCITY. R. C. Cairns and K. S. Turner. Sept. 1958. 39p.

Data are presented for the horizontal settling velocities of small particle suspensions. The effect of concentration, pipe diameter and effective density ratio were determined. In almost all cases a moving bed was formed before a stationary bed. For small concentrations, up to several per cent by volume, the effect of concentration was negligible. An empirical equation was derived which is applicable to both moving and stationary bed conditions. This equation was found applicable for effective density ratios of 1.7 to 18.3 and pipe diameters of 0.75 to 2 in. The Reynolds number of a suspension was not a true indication of the degree of turbulence or particle suspension. (For preceding part see AAEC/E-37.) (auth)

12324 CEA-1198
France. Commissariat a l'Énergie Atomique, Paris.
ÉTUDE DE LA LUMIÈRE ÉMISE DANS LE MODÉRATEUR DUNE PILE A EAU LOURDE. (Study of the Light in the Moderator of a Heavy-water Pile.) Denis Breton. June 14, 1958. 57p.

Thesis submitted to the Univ. of Paris.

A study was made of the theory that the light emitted from the moderator of a reactor of the same type as that at Fontenay-aux-Roses is produced solely by the Cherenkov effect. The spectroscopic study of the light emitted, carried out by comparison with a tungsten ribbon lamp, shows an energy spectrum distribution identical with that characteristic of the Cherenkov effect. The calculated brilliancy of the light source, assuming that all the light is produced by Cherenkov effect, is in good agreement. The variations in light intensity as a function of the running power of the pile were also studied. From this it is deduced that the light produced by Cherenkov effect corresponds to a source emitting about 2×16^6 photons per cm^3 of water in a spectral region ranging from 4,000 to 7,000 A, when the pile power is equal to 1 watt. (auth)

12325 CISE-72
Centro Informazioni Studi Esperienze, Milan.
FURTHER CALCULATIONS FOR THE PRELIMINARY DESIGN OF FUEL ELEMENTS FOR A PRESSURE TUBE, WET STEAM COOLED REACTOR. I. Casagrande and L. Cravarolo. Dec. 1959. 50p.

This is a continuation of studies reported in CISE-68.

A calculation method is reported for the preliminary design of metallic fuel elements for a pressure tube, wet steam cooled reactor. The calculation method takes into account the maximum permissible fuel temperatures, mechanical safety of fuel, safety against burnout, and coolant pressure drops. (W.L.H.)

12326 GEAP-3121
General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.
NEUTRON AND GAMMA FLUX ATTENUATION IN A WITHDRAWN SRE CONTROL ROD. K. M. Horst and P. G. Aline. Mar. 20, 1959. 21p. For Atomics International Div. Contract N8-S-452. OTS.

An investigation was made of the neutron and gamma flux distribution along the entire length of a withdrawn control rod in the SRE in order to determine heating, activation and dose rates produced by the streaming neutrons and gammas. The collimated beam of neutrons and gammas emanating from the void control channel stream long distances through the void in the control rod before attenuation occurs. The results of the analysis indicate that the increased dose rate from the neutron and gamma streaming is small compared with the total dose rate over the biological shield surface. The neutron streaming dose rate along the length of the control rod is compared with the neutron dose rate in the surrounding bulk material. Also, the neutron activation and heating and the gamma heating from the streaming flux are negligible compared with the effects from the surrounding bulk material (core, sodium, and bulk shield). (auth)

12327 HW-62846
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
HYDRAULIC SYSTEM FLOW DECAY RELATIONS DURING LOSS OF EXTERNAL POWER. W. J. Love. Feb. 11, 1960. 54p. OTS.

Flow decay relations for reactor flow transients caused by pump outage during loss of external power were examined for simple and complex pumping systems having both series and parallel units. Decay equations with allowance for fluid inertia and flywheel are presented. Exact solutions of equations for the decay of a single pump set when two series pump sets supply total system head are given for special cases and the limiting condition is shown for the limiting case. Equations were developed for the decay of one or more pumps when several subsystem loops supply a recirculating system. The limit conditions for the special case of negligible fluid inertia were determined. Decay curves are presented for pumping systems with the following parameters being varied: pump numbers up to 8, H_A/H_O varied from 0 to 0.5, and θ varied from 0.1 to 0.4. (C.J.G.)

12328 KAPL-M-CEW-11
Knolls Atomic Power Lab., Schenectady, N. Y.
CHALK RIVER HEAT GENERATION AND FUEL BURNUP DATA. C. E. Weber. Mar. 12, 1952. Decl. Mar. 2, 1960. 12p. Contract W-31-109-Eng-52. OTS.

Studies of fuel burnup and the fuel burnup rate at NRX Reactor were made. Data from in-pile measurements of fission rate based on heat generation were correlated with data on radiochemical determination of fuel burnup rate and the NRX estimated dosage. (T.R.H.)

12329 NAA-SR-Memo-4866
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
EVALUATION OF THE USE OF DELAYED NEUTRON AND GASEOUS FISSION PRODUCT MONITORING FOR DETECTION OF FUEL CLADDING FAILURES IN ADVANCED OMR'S. C. C. Weeks. Jan. 11, 1960. 16p. OTS.

Activity aimed at developing a monitor for gaseous fission products in OMR coolant is outlined. The program is for research on a suitable device to detect cladding failures so that defective elements can be removed before escape of fission products has created a major hazard. Results of calculations are included. (J.R.D.)

12330
FAST REACTORS. Leonard J. Koch (Argonne National

Lab., Lemont, Ill.) and Hugh C. Paxton (Los Alamos Scientific Lab., Albuquerque, N. Mex.). Ann. Rev. Nuclear Sci. 9, 437-72(1959).

A review of the United States, Russia, and United Kingdom fast reactor and fast critical assembly programs is given. Critical size, perturbation, and spectral data obtained from fast critical assemblies are treated. Coolant and heat transfer problems, control and kinetics transient accidents, and fuel cycles of fast reactors are discussed. (C.J.G.)

12331

THERMAL STRESSES IN REACTOR STRUCTURES. A. Ya. Kramerov, Ya. B. Fridman, and S. A. Ivanov. Atomnaya Energ. 8, 101-11(1960) Feb. (In Russian)

An analysis is made of the conditions inducing thermal stress in reactors, and the stress magnitudes and dangers are evaluated. The effects of fuel element configuration on temperature drop and thermal stress are analyzed, and suggestions are made for reducing the harmful effects of thermal stress. The method of elasticity is not sufficient in many cases for evaluating the magnitude of thermal stresses. In summing mechanical and thermal stresses and seeking means for reducing stress, it is recommended that greater consideration be given of fluidity, creep, initial decomposition, and microscopic processes. (tr-auth)

12332

A TRANSPORTABLE NEUTRON MULTIPLIER. T. A. Lopovok. Atomnaya Energ. 8, 158-9(1960) Feb. (In Russian)

A subcritical uranium—water assembly for installation in a 4-ton pick-up truck was designed for geological field explorations. The maximum multiplication factor of the assembly is $K_{eff} = 0.997$. The initial capacity of the plutonium—beryllium source is $\sim 5 \times 10^7$ n/sec; the fuel elements of up to 10% enriched uranium are placed in vertically distributed aluminum tubes, and natural water acts as moderator and reflector. The height and diameter of the cylindrical active zone is ~45 and 42 cm, respectively. The maximum lattice spacing of 18 mm and the geometry of the assembly make it safe even in an automobile accident. Experiments can be carried out simultaneously in all five 52-mm channels in the reflector. The assembly has proved safe, compact, and efficient in field explorations. (R.V.J.)

12333

CHEMISTRY PROBLEMS OF NUCLEAR REACTOR WITH LIQUID FUEL MATERIAL. Th. van der Plas. Chem. Weekblad 55, 429-38(1959). (In Dutch)

The chemical problems of reactors employing liquid bismuth, molten fluorides, solutions in water, and suspensions in water as fuel materials are discussed. (Reactor Centrum Nederland).

12334

SOME TECHNOLOGICAL PROBLEMS CAUSED BY NUCLEAR FUEL. M. Englander (Centre d'Études Nucléaires, Saclay, France). Énergie nucléaire 2, 33-43(1960) Jan.-Feb. (In French)

The essential concepts considered for the utilization of nuclear fuels in reactors (neutron multiplication factor, thermal utilization factor, macroscopic cross section, consumption rate during the chain reaction, and power released) are defined. The technological problems associated with these concepts, particularly those related to the structure and texture of the fuel, are described. For diverse forms of available nuclear fuels (enriched or nonenriched uranium metal, alloyed uranium, refractory compounds, and dispersed fuels), the effects of composition and method of production on the characteristics sought are examined. (tr-auth)

12335

METALLIC URANIUM WET-STEAM-COOLED FUEL ELEMENT CALCULATION. I. Casagrande (Centro Informazioni Studi Esperienze, Milan). Energia nucleare (Milan) 7, 175-91(1960) Mar. (In Italian)

The fuel elements of a nuclear reactor have to meet many stringent requirements with regard to mechanical and thermal as well as nuclear characteristics of the fuel itself, cladding materials and coolants. General considerations on the various kinds of fuel elements are given and a calculation scheme for a preliminary design of alloyed metallic uranium, wet-steam cooled fuel elements is reported. (auth)

12336

PRESTRESSED CONCRETE REACTOR PRESSURE VESSEL. Radim Servít (Czech Technical Univ., Prague). Jaderná energie 6, 37-45(1960) Feb. (In Czech.)

A comparison is made between prestressed concrete and steel for reactor pressure vessels. The requirements for a reactor pressure vessel are discussed. (C.J.G.)

12337

NEUTRON ABSORPTION BY CONTROL RODS OF VARYING TRANSPARENCY. H. Überall (General Atomics Div., General Dynamics Corp., San Diego, Calif.). Nuclear Sci. and Eng. 7, 228-34(1960) Mar.

Neutron fluxes and currents in the vicinity of control rods inside reactors are calculated in age-diffusion theory, using a control rod in the form of an infinite plane slab and approximating its transparency by a simple analytical expression. The results are compared with a two-group calculation for the same geometry and indicate the degree of accuracy of the latter method. The comparison is made for epithermal neutron energies only, and shows that in this region, two-group theory is applicable for a calculation of the number of neutrons absorbed by the control rod with a fair accuracy. (auth)

12338

A USEFUL ANALOGY FOR SINGLE-GROUP NEUTRON DIFFUSION THEORY. James R. Melcher (Iowa State Univ. of Science and Tech., Ames). Nuclear Sci. and Eng. 7, 235-9(1960) Mar.

It is shown that an analogy exists between the neutron flux as predicted by single-group neutron diffusion theory and the axial component of the electric field intensity in a field excited as a plane transverse-magnetic wave in a cylindrical cavity. The buckling of a homogeneous bare core could be determined using simple microwave devices to an accuracy on the same order as the uncertainty of the cavity dimensions. Experimental techniques are described for measuring control rod worth for fully extended cylindrical control rods of arbitrary cross section. Illustrative solutions are shown for circular, hexagonal, square, cruciform, "Y," and sheet cross sections located at the center and at radial positions in a circular core. A method is described for predicting the flux distribution in the core region and experimental examples are shown. (auth)

12339

SLOWING DOWN OF NEUTRONS IN GRAPHITE CLOSE TO THERMAL EQUILIBRIUM. L. S. Kothari and P. G. Khubchandani (Atomic Energy Establishment, Trombay, India). Nuclear Sci. and Eng. 7, 240-4(1960) Mar.

Elastic and one-phonon inelastic scattering cross sections of neutrons in graphite were calculated for neutron energy less than 2000 k_0. For the lattice vibrations in graphite, the model proposed by Krumhansl and Brooks was used. The mean energy loss per collision and the mean logarithmic energy decrement were calculated. Assuming that close to equilibrium the neutron distribution remains Maxwellian, the time variation of the temperature of this distribution was calculated. The slowing down relaxation time near equilibrium came to nearly 170 μsec, which compares well with the experimental value of 185 ± 45 μsec. (auth)

12340

THE TIME-DEPENDENT IMPORTANCE OF NEUTRONS AND PRECURSORS. Jeffery Lewins (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 7, 268-74 (1960) Mar.

A condensation of this paper was previously abstracted and appears in NSA, Vol. 13, as abstract No. 17475.

12341

DELAYED NEUTRON EFFECTS DURING FLUX TILT TRANSIENTS. S. Kaplan and S. G. Margolis (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 7, 276-7(1960) Mar.

The delayed neutron effects in flux tilt transients were examined in a simple model of an initially uniform bare core with energy group and one group of delayed precursors. Transient behavior of the flux shape was examined by a first-order perturbation theory and a modal expansion. (C.J.G.)

12342

ANALYSIS OF NEUTRON FLUX DATA FOR ACCURATE DETERMINATION OF RELAXATION LENGTH. Leo Seren and Denis Tsakarissianos (International School of Nuclear Science and Engineering, Lemont, Ill.). Nuclear Sci. and Eng. 7, 277-80(1960) Mar.

An appropriate weighting factor to be used in the process of making a least squares fit of neutron flux data for determining relaxation length is given. That factor is $1/y_i^2$, where y_i is the value of the flux at position x_i. (C.J.G.)

12343

PROEVEN OVER DE WARMTE-AFVOER VAN EEN SPLIJTSTOFELEMENT UIT EEN KERNREACTOR VAN HET KOKEND WATER TYPE. (Experiments on the Heat Discharge of a Fission Element in a Boiling-Water Type Nuclear Reactor). Johannes Asijee. Thesis, Delft, Netherlands, Technological University, 1959. 88p.

The relationship between reactor power and the vapor content in a boiling reactor may yield a high degree of self-regulation. It is not possible to predict with sufficient accuracy the vapor content in a given coolant channel without the aid of experimental data. For the Halden Boiling Water Reactor (Norway) such information has been obtained from experiments with a full scale model of a coolant channel. For three different geometrical situations, the relationships between steam-production, water circulation rate, steam void fraction, and temperature or pressure were investigated for the natural circulation evaporation of water in an annular space around an electrically heated, vertical, cylindrical heating element. Special measures were taken in order to obtain results under steady-state conditions. (Reactor Centrum Nederland).

12344

NEON AS COOLANT FOR GRAPHITE-MODERATED HIGH-TEMPERATURE REACTORS. (to Brown, Boveri & Cie., Aktiengesellschaft and Aktiengesellschaft für Unternehmunger der Eisen- und Stahlindustrie). German Patent DAS 1 058 164. May 27, 1959. Atompraxis 6, 70-1(1960). (In German)

Among the chemically inactive rare gases, helium has already been proposed as a reactor coolant. However, because of its scarcity and price in the pure form, it can not be used at the present. The rare gases with higher atomic weight necessitate fairly high pumping power since their specific heats are low. Also they form radioactive isotopes. Neon with atomic weight about 20, with respect to the pumping power necessary, is the best gas after helium. Its heat conductivity is only surpassed by hydrogen and helium. Neon has not been considered as a coolant since it was feared that its high absorption cross section for thermal neutrons would adversely affect the neutron balance of the reactor. It is shown, however, that the absorption cross section of neon is much lower than was assumed. Therefore neon is shown to be a very satisfactory coolant.

12345

DETECTION OF LEAKS IN FUEL ELEMENT CLADDING BY MEASUREMENT OF TORSIONAL STRESS. (to LICENTIA Patent-Verwaltungs-G.m.b.H.). German Patent DAS 1 059 583. June 18, 1959. Atompraxis 6, 71(1960). (In German)

In the operation of reactors it is essential to detect early damage to the cladding of fuel elements. For the detection of such damage it was proposed to use the torsional resistance of the cladding. Rod-like fuel elements were installed in a reactor so that during the operation they are held under a torsional stress. This can be done, for example, with a twisting of the inner or outer fastening of the clad fuel elements. By various common measurement methods, the stress resistance of the rod was monitored. If damage occurred during operation, it would be noticeable from a change in the torsional resistance.

12346

FUEL ELEMENTS WITH NON-METALLIC CLADDING FOR REACTORS. (to Deutsche Gold- und Silber-Scheideanstalt vormals Roessler). German Patent DAS 1 062 834. Aug. 6, 1959. Atompraxis 6, 71(1960). (In German)

The proposal concerns shaped, especially spherical, fuel elements which consist of fissionable or breeder material and a filler and are covered with a non-metallic cladding. An artificially increased porosity is given to the molded core and the cladding. For the coating, materials were selected which after sintering, exhibited an increased abrasion resistance. The consideration of the abrasion of the molded bodies on each other or the surface abrasion by the reactor coolant is limited to the substance forming the cladding. This means that the coolant dissolves no fissionable material. The radioactive fission products produced in the interior of the fuel element do not appear in the coolant but are absorbed by the cladding material in the boundary layers. These fuel elements are especially applicable in reactors with high operating temperatures. It is also proposed that the cladding consist of sintered high-melting metal oxides of elements with high atomic weight, such as barium oxide.

Power Reactors

12347 ACNP-5924

Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee. PATHFINDER ATOMIC POWER PLANT TECHNICAL PROGRESS REPORT [FOR] JULY 1, 1959—SEPTEMBER 30, 1959. 118p. For Northern States Power Co. and

Central Utilities Atomic Power Associates. Contract AT(11-1)-589. OTS.

Fuel Element Research and Development. Dynamic and static corrosion tests on 8001 Al were completed. Annealing of 1100 cladding on 5083 and M400 cladding on X2219 were tested at 500°C, and investigation continued on producing X8001 Al alloy cladding in tube plates by extrusion. Boiler fuel element capsule irradiation tests and subassembly tests are described. Heat transfer loop studies and fuel fabrication for the critical facility are reported. Boiler fuel element mechanical design and testing progress is described, and the superheater fuel element temperature evaluating routine is discussed. Low-enrichment superheater fuel element development included design studies and stainless steel powder and UO_2 powder fabrication studies. Reactor Mechanical Studies. Research is reported on vessel and structure design, fabrication, and testing, recirculation system design, steam separator tests, and control rod studies. Nuclear Analysis. Reactor physics studies are reported on nuclear constants, baffle plate analysis, comparison of core representations, delayed neutron fraction, and shielding analysis of the reactor building. Reactor and system dynamics and critical experiments were also studied. Chemistry. Progress is reported on recombiner, radioactive gas removal and storage, ion exchanger and radiochemical processing. (For preceding period see ACNP-5915.) (T.R.H.)

12348 APAE-17(Vol. I)(Suppl. 2)
Bechtel Corp., San Francisco.
PHASE III REPORT—ARMY PACKAGE POWER REACTOR FIELD UNIT NO. 1 APPR-1a. E. M. Reiback, ed. July 16, 1958. 44p. For Alco Products, Inc. Contract DA-95-507-ENG-940(NEG).

A design analysis is made of a primary shield for the APPR-1a. This primary shield consists of a steel support ring, a water annulus, a second steel ring, and a surrounding cylinder of concrete. Surveys are made in which the width of the water annulus is varied to achieve the minimum shutdown dose rate due to both core decay gammas and neutron activation. The optimum water annulus width is found to be 14.5". An analysis is made of the dose rate in the control rod drive pit when the above primary shield is used. Lead and Boral are added to regions of the primary shield directly above the control rod drive pit to reduce the estimated dose to tolerance levels. An analysis is made of the gamma heating expected in the primary shield, and the conclusion is drawn that no problem conditions exist. (auth)

12349 BAW-1094
Babcock and Wilcox Co. Research Center, Alliance, Ohio.
LIQUID METAL FUEL REACTOR EXPERIMENT—INVESTIGATION OF PRECLEANING AND DECONTAMINATION METHODS. W. S. Leedy. Feb. 1960. 37p. Contract AT(30-1)-1940. OTS.

In the Experimental Liquid-Metal Fuel Reactor (LMFRE), the steel surface exposed to the fuel solution must be cleaned prior to service, and radioactive contaminants must be removed from the system after service. To determine effective procedures, Croloy 2-1/4 specimens containing an artifically induced oxide scale were treated with various solvents, afterwhich the corrosion rates were determined. In addition, bismuth solubility in various solvents was determined, and fission product and corrosion product solubility was investigated. (auth)

12350 CF-57-11-3(Rev. 1)
Oak Ridge National Lab., Tenn.
AN ANALYSIS OF VORTEX TUBES FOR COMBINED GAS-PHASE FISSION-HEATING AND SEPARATION OF THE FISSIONABLE MATERIAL. J. L. Kerrebrock and R. V. Meghreblian. Apr. 11, 1958. Decl. Dec. 21, 1959. 107p. Contract [W-7405-eng-26]. OTS.

In order to achieve the high exhaust gas temperatures, which are desirable if the full potential of nuclear fission as an energy source for rocket propulsion is to be realized, it seems essential that the fissionable material be maintained in a gaseous mixture with the propellant. It is then necessary to separate the fissionable material from the propellant before discharging the latter, since the loss of fissionable material is prohibitive otherwise. This report presents an analytical evaluation of the characteristics of a vortex tube which achieves the desired separation by means of a centrifugal field. Propellant is fed into the tube tangentially, at the periphery, and diffuses radially inward through a cloud of fissionable gas, picking up the fission heat as it goes. The fissionable gas is held against this radial propellant flow by the centrifugal vortex field generated by the tangentially entering propellant. The analysis involves several assumptions, the most important of which are that the flow is laminar and that it is inviscid. A set of non-linear first order differential equations is obtained which is sufficient to describe the fissionable gas concentration, temperature, and pressure distributions in the tube. These equations have been integrated numerically for a very wide range of conditions. The analysis predicts that the vortex tube is capable of maintaining rather high concentrations of fissionable gas, such that the density of the fissionable gas is of the same order as that of the propellant, with negligible loss of the fissionable gas, and with ratios of propellant exit temperature to entrance temperature up to ten. (auth)

12351 CF-60-3-1
Oak Ridge National Lab., Tenn.
NUMERICAL THREE DIMENSIONAL TEMPERATURE ANALYSIS OF THE EGCR FUEL ROD. L. G. Epel. Mar. 21, 1960. 16p. Contract [W-7405-eng-26]. OTS.

The temperature field in an outer rod of the Experimental Gas Cooled Reactor fuel assembly is presented. The numerical analysis has taken account of the three-dimensional spatial dependence of the thermal neutron flux and has considered the four regions involved, that is, fuel pellets, ceramic disc, steel end caps, and cladding. The convective heat transfer coefficient and fluid temperature were considered constant over the 2.185 in. of rod length studied. (auth)

12352 HW-63902(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRELIMINARY EVALUATION OF CHLORINE FOR USE AS A GAS COOLED REACTOR SAFEGUARD. R. E. Dahl. Mar. 8, 1960. 19p. Contract AT(45-1)-1350. OTS.

An evaluation of chlorine in a high-temperature gas-cooled graphite-moderated reactor as a safeguard to control a runaway oxidation reaction was made. Experiments were performed which demonstrated the ability of a small amount of chlorine in an air stream to reduce the oxidation rate of graphite. Chlorine appeared to inhibit graphite oxidation by blocking active sites on the surface. On the basis of this mechanism, a rate law was derived which was consistent with observed behavior. (C.J.G.)

12353 LRL-79(Del.)
California Research and Development Co. Livermore Research Lab., Livermore, Calif.
A STUDY OF MULTIPURPOSE PLANTS AS AN APPROACH TO COMPETITIVE NUCLEAR POWER. Dec. 1953. Decl.

with deletions Jan. 29, 1960. 71p. Contract AT(11-1)-74. OTS.

Various reactor design concepts are examined from the viewpoint of operation to produce power, weapons grade plutonium for a limited period, and fuel grade plutonium. It is concluded that this multipurpose plant approach has attractive possibilities and may provide a means for accelerating entrance of private industry into the nuclear power business. The effects on costs of a wide range of variables are presented to facilitate determination of economic areas of potential interest. (auth)

12354 NAA-SR-Memo-4335
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
DEVELOPMENT TEST OF THE HNPF HANGER-ROD DISCONNECT-LATCHES AND DISCONNECT ACTUATOR. M. L. Peelgren. Dec. 8, 1959. 17p. OTS.

A study was conducted to determine the suitability of various latch configurations for HNPF hanger-rod disconnects and actuators. The pawl, finger, and roller type latches were satisfactory, and it is recommended that the selection of one latch from these be made on the basis of cost. (J.R.D.)

12355 NYO-2709
Sanderson and Porter, New York.
THE PEBBLE BED REACTOR PROGRAM. Quarterly Progress Report [for] October 1, 1959 through December 31, 1959. 38p. Contract AT(30-1)-2207. OTS.

A shallow adsorber bed operating in a helium stream was analyzed for decontamination of the primary loop. A theory is proposed that if the half life of the adsorbate is of the same order as the saturation time of the bed, the effluent concentration at saturation becomes asymptotic to a value of C/C_0 less than 1.0 where C is the concentration at any time and C_0 is the concentration at time zero. Calculation results for the critical radius of a spherical core using the PBR nuclear model are discussed. Revisions were made to the two-group model in an attempt to correct for the negative fluxes. Other terms are re-defined to show how the U^{233} and Th^{232} in the PBR are handled. Corrections are made to the infinite dilution resonance integrals for U^{233} and Th^{232}. For machine calculations, it was decided to develop two group constants using GNU which could be used in radical Wanda cases. A quarter scale model of the PBR core was constructed to study the effect of bottom grate geometry and the use of a flow diverter over the fuel element outlet on the radial ball flow rate. The flow characteristics of the bed were determined, as influenced by bottom grate angle. (C.J.G.)

12356 PRDC-TR-28
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] PERIOD OCTOBER 1959. 23p. Contract AT(11-1)-476. OTS.

Developmental investigations concerning core design, corrosion, fast reactor fuel elements, nuclear engineering, reactor vessel engineering, mechanical handling, reactor components instrumentation, liquid metal and steam systems, and reactor component test operations are described. Data on environmental radioactivity levels at several locations around the Fermi Reactor are included. (For preceding period see PRDC-TR-27.) (J.R.D.)

12357 PRDC-TR-29
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] PERIOD NOVEMBER 1959. 28p. Contract AT(11-1)-476. OTS.

Developmental investigations concerning core design, nuclear engineering, mechanical handling, liquid metal and steam systems, and reactor component test operations are described. Data on environmental radioactivity levels at several locations around the Fermi Reactor are included. (For preceding period see PRDC-TR-28.) (J.R.D.)

12358 TID-5715
Duquesne Light Co., Shippingport, Penna.
LEVELING OF ESTRACTION TOOL CRANE RAILS. THIRD PERFORMANCE. CORE 1, SEED 1. Test Results DL-S-246. First issue, Feb. 24, 1960. 7p.

The level of the extraction crane rails along the entire length of the fuel handling canal was checked. (W.L.H.)

12359 TID-5716
Duquesne Light Co., Shippingport, Penna.
FLOW COASTDOWN TEST. SECTION I. SECOND PERFORMANCE. CORE I, SEED I. Test Results DL-S-179 (T-612087). First issue, Mar. 1, 1960. 28p. OTS.

Studies were made to determine the rate of flow coastdown in the reactor coolant system upon loss of power to the reactor coolant pumps. The rate of flow coastdown during the first three seconds after loss of power to the reactor coolant pumps was faster than predicted but was ~ the same as that observed during the first performance test. The flow coastdown characteristics for three pump operation was essentially the same as for four pump operation. Flow continued for ~ 28 seconds after shutdown of the reactor coolant pumps. The 1D pump has a slower rate of flow coastdown than the 1B pump, but the maximum flow rate of the 1D pump was less. (W.L.H.)

12360 TID-5723
Duquesne Light Co., Shippingport, Penna.
CHARGING PUMP CAVITATION TEST. SECTION I. FIRST PERFORMANCE. CORE 1, SEED 1. Test Results DL-S-289 (T-641322). First issue, Feb. 23, 1960. 6p. OTS.

Studies were made to determine if the charging pumps will cavitate when pumping water at a temperature of 145°F and an average suction head of ~ 2 feet of water. These are the maximum conditions expected during boric acid addition. Cavitation did not occur in the 1A or the 1B charging pumps. (W.L.H.)

12361 YAEC-160
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
THE FORMATION AND STATISTICAL EVALUATION OF "DIFFUSION BONDED" BRAZED JOINTS IN YANKEE FUEL SUBASSEMBLIES. P. P. King. Nov. 1959. 34p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

The factors controlling the formation and growth of "diffusion bonded" joints in fuel tube-to-ferrule joints were investigated. Joint strengths in fuel element subassemblies with varying brazing alloys and brazing cycles were compared and evaluated by statistical analyses of joint fracture loads from prototype subassemblies. Joint clearance was found to be the most critical factor controlling the formation and growth of "diffusion bonded" areas in fuel tube-to-ferrule joints. Clearances below 0.0025 inches were found necessary for "diffusion bonding." Joint strengths were found to increase with time at temperature if the joint clearances were within the range specified. Preplacement of the brazing alloy by plating one of the components eliminated voids and porosity at the joint centers which are caused by lack of braze flow into joint clearances below 0.0005 inches. Joint strength data taken from single joint specimens did not represent the joint strength level in full sized subassemblies because variations of joint clearances in multiple tube subassemblies lowered the average joint strength appreciably. Statistical evaluation of joints taken from full sized subassemblies was found to give the most accurate representation of fuel element strength and quality. (auth)

12362 DEGIS-20(R)

UTILIZATION OF NUCLEAR ENERGY FOR SHIP PROPULSION IN GERMANY. K. Illies. Translated by J. McDonald (U.K.A.E.A., Risley) from Atoomenergie 5, 74-6(1959). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 15796.

12363 T-106(RAND)

ON AN ATOMIC AIRPLANE. V. Artamkin. Translated by C. M. Weber, Jr. from Atomnaya Energ. 4, 389-91(1958). 9p.

A discussion concerning aspects of atomic airplane design is presented. Crew protection and associated weight factors are examined, and engine design features are covered. A review of general activities along this line in the U.S., England, and France is included. (J.R.D.)

12364

ECONOMICS OF NUCLEAR POWER. James A. Lane (Oak Ridge National Lab., Tenn.). Ann. Rev. Nuclear Sci. 9, 473-92(1959).

Nuclear power forecasts and projected growths of nuclear power in the United States to 1980 are reviewed. Reactor inventory and burnup requirements and distribution of reactor types are tabulated. The production rates to 1980 in the United States and the reserves of nuclear materials in the world are given. The capital costs of first-generation and prototype power plants are summarized. Fuel cycle costs in various solid-fuel and liquid-fuel reactors are presented. (C.J.G.)

12365

FIRST SCANDINAVIAN PROJECT FOR A TANKER WITH NUCLEAR PROPULSION. F.-A. Abadie-Maumert. Énergie nucléaire 2, 44-5(1960) Jan.-Feb. (In French)

The first Scandinavian studies on a nuclear tanker were published recently in Sweden. The originality of the plan, which at the present is only a study, lies in the placement of the superstructure, command posts, auxiliary machinery, and equipment storage in the stern of the ship. Six auxiliary diesels with a total power of 4000 kw are provided. Although the cost of the tanker was determined with great precision, the construction date was not decided. (J.S.R.)

12366

DEVELOPMENT OF THE GAS-COOLED REACTOR IN GREAT BRITAIN. I. Casagrande and S. Villani (Centro Informazioni Studi Esperienze, Milan). Energia nucleare (Milan) 7, 141-58(1960) Mar. (In Italian)

The research and development work being presently carried out in Great Britain in the field of high temperature reactor systems is described. Both the AGR and the Dragon project (including the zero energy reactor experiment Zenith) are briefly illustrated. (auth)

12367

LOADING AND UNLOADING A NUCLEAR REACTOR. Engineering 189, 328(1960) Mar. 4.

A description is given for machines at Berkeley used in charging fuel into the reactors. The process through which the charging machine goes is reversed for the unloading process. The operation of the CRASM, control rod and actuator servicing machine, is explained for contaminated and clean actuators. A closed-circuit television system incorporated in the visual observation and removal equipment (VORE) enables limited observation of the interior of the reactor and is equipped for removal of broken fuel elements. A flux scanning winch is described which is used for determining future fuel requirements. This operated in conjunction with the flux scanning chute, lowers a tungsten wire into the reactor, where the wire absorbs activity at a rate dependent upon the condition of the surrounding fuel elements. (B.O.G.)

12368

THE STABILITY OF VARIOUS GASES AS WORKING MEDIA FOR A NUCLEAR REACTOR-GAS TURBINE COMBINATION. W. Pflaum and D. Reiher. Engrs. Digest 21, No. 2, 94-5; 127(1960) Feb.

Various gases were examined relative to their possible utilization as coolants and working media in a closed circuit comprising a nuclear reactor and a gas turbine. Helium was found to be the most suitable medium. (C.J.G.)

12369

THE REACTOR PROJECT AT PETTEN. I. GENERAL DESIGN. J. A. G. van der Steur (J. van Hasselt, Nijmegen, Netherlands). Ingenieur, (Utrecht) 71, A435-48(1959). (In Dutch)

The considerations leading to the choice of the site near Petten for the reactor complex are discussed. The principal buildings are discussed and the sealed dome and the heavy concrete of the reactor vessel are described in some detail. The cost is estimated. (auth)

12370

THE MEASUREMENTS, CONTROL, AND REGULATION IN A NUCLEAR POWER PLANT. G. Cahen (Compagnie des Compteurs, Montrouge, France). Ingenieur, (Utrecht) 71, E113-19(1959). (In French)

The control and measurement techniques which were chosen for the Chinon nuclear power plant are indicated. (auth)

12371

ATOMIC PROPULSION OF SHIPS. R. Muller. Ingenieur, (Utrecht) 71, W157-65(1959). (In English)

The history of the development of the U. S. Navy's nuclear submarine propulsion program is briefly reviewed. The factors which influence nuclear ship design are discussed and compared with more conventional propulsion design factors. Of special interest are the influences of nuclear radiation and the exceptional endurance which are characteristic of nuclear ships. The construction materials are reviewed and the desirable features of the pressurized water reactor systems are explained. The importance of safety in nuclear ships is emphasized, and methods of achieving it are discussed. Opportunities to apply novelties in design are more limited in the nuclear than in the conventional case. New yardsticks for measuring ship values must be applied to nuclear ships. (auth)

12372

THE APPLICATION OF THE OMR TO SHIP PROPULSION. Frank E. Faris (Interatom, Bensberg, Ger.). Ingenieur, (Utrecht) 71, W166-70(1959). (In English)

A survey is given of the properties of organic liquids which make them attractive for use as moderator and coolant in nuclear reactors. The OMR reactor is described in general, and details are given of the organic reactor for ship propulsion now being designed in Germany. (auth)

12373
POWER FROM GAS-COOLED REACTORS. E. E. Thum. Metal Progr. 77, 123-6(1960) Apr.

Some of the aspects of power generation by reactors using gaseous coolants; enriched or natural uranium in the form of metal, oxides, carbides, or compacts; and various moderators are given. Experience obtained in Great Britain from gas-cooled reactor power stations which use natural uranium as fuel and CO_2 as coolant is discussed and compared with United States proposals for enriched fuels and higher exit temperatures. Other concepts for fuel element design, coolant possibilities, and moderators are discussed conjunctively or separately. (B.O.G.)

12374
IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Vernon Warner David and Willem Johannes Dominicus Van Dijck (to Shell Research, Ltd.). British Patent 831,369. Mar. 30, 1960.

An organic-cooled and -moderated reactor is proposed and the organic liquid used is described. The coolant is obtained from the cracking of hydrocarbon oils and consists principally of the furfural extract with a boiling point of 250°C. Experimental data are given to demonstrate radiation stability of the oil. (T.R.H.)

12375
IMPROVEMENTS IN AND RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Edward Rae Elliott and David Charles Brown (to C. A. Parsons & Co., Ltd.). British Patent 831,433. Mar. 30, 1960.

A finned fuel element design adapted for coupling to adjacent fuel elements is described. The welded connections in this arrangement are under tension or compression, rather than shear stress. (T.R.H.)

12376
IMPROVEMENTS IN OR RELATING TO CONTROL SYSTEMS FOR NUCLEAR REACTORS. Peter Forsdike Hartshorn (to General Electric Co., Ltd.). British Patent 832,366. Apr. 6, 1960.

A reactor control system is described which regulates power as a function of the relation between actual power and desired power. The controls are actuated with respect to an error voltage derived from the difference between reactor power and a feedback voltage from a potentiometer tapping. The potential difference across the ends of the potentiometer depends on the sum of the error voltage and a reference voltage. The tapping is set at the desired power level. A stabilizing network is provided to minimize oscillation by making the error voltage depend on rate of change of power with time. (T.R.H.)

Research Reactors

12377 AERE-M/M-33
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN APPARATUS FOR PRODUCING LOW TEMPERATURES IN B.E.P.O. B. G. Childs. [1952?] 5p.

An apparatus is described which was constructed to "freeze-in" irradiation damage in solids. The apparatus is to be used for conducting tests in BEPO at liquid nitrogen temperatures. (W.D.M.)

12378 CEA-1205
France. Commissariat à l'Énergie Atomique, Paris.
ETUDE NEUTRONIQUE DE MELUSINE. (Nuclear Study of Melusine). J. Cherot. 1959. 77p.

The main nuclear characteristics of a 20 per cent enriched uranium lattice with light water as moderator and reflector are presented. The reactor is to operate at 1 Mw. The studies included: study of various critical masses, control effectiveness of cadmium, control rods, and stainless steel regulating rod, the effect on reactivity of disturbances in the cove center, study of xenon and samarium poisoning, temperature factor, and heat exchanges in a fuel element. (auth)

12379 CEA-1233
France. Commissariat à l'Énergie Atomique, Paris.
ACTIVITE γ ET ECHAUFFEMENT DES BARRES DE EL2 ET EL3. (γ Activity and Heating of Rods in EL2 and EL3). J. Lalere. 1959. 37p.

A method is described for calculating the γ activity of uranium rods, given the mean flux in which they are irradiated, the time they remain in the pile and the duration of deactivation. This calculation leads to numerical formulas which may be applied to the rods of the two reactors. It allows the saturation activities to be foreseen both for EL2 and for EL3, taking into account the minimum times necessary for extraction. Measurements have been carried out, and the results are in good agreement with those foreseen by calculation. In the last section this method is used to calculate the heating of the irradiated rods. (auth)

12380 CEA-1259
France. Commissariat à l'Énergie Atomique, Paris.
PROJET EL 3. (The EL-3 Project). V. Raievski. Jan. 1956. 146p.

A description is given of the physical problems encountered during the EL 3 pile project: choice of fuel elements, estimation of the most favorable lattice, neutron flux distribution, perturbations produced by experimental installations. In an enriched high-flux pile an important factor is the production of heat in the regions outside the core, and particular attention has been given to this question. Problems of radioactivity are studied next: activity of the heavy water circuit, performance of the gaskets, activity of the air circuit, doses in the neighborhood of the evacuation chimney. The control system is described, and the reasons which led to the choice of its characteristics; the possibility of using the neutrons absorbed by the control rods to obtain useful isotopes has been considered. Next the problem of heat transfer between the canning and the cooling fluid is studied; this problem is essential in a high-flux low-temperature pile, and to solve it experiments had to be carried out on electrically heated elements. Finally security problems are discussed, particularly the choice of the sealed container which, in the event of an accidental power surge producing a burst in the tank, would confine the activity released. The charge foreseen originally was made up of uranium enriched to 1.4 per cent and mixed with 5/1000 of aluminum by weight. The first charged used consisted of uranium enriched to 1.35 per cent and combined with 1.5 per cent by weight of molybdenum, which means increasing the critical masses calculated in this project. (auth)

12381 GA-1263
General Atomic Div., General Dynamics Corp., San Diego, Calif.
APPLICATION TO UNITED STATES ATOMIC ENERGY COMMISSION FOR CONSTRUCTION PERMIT AND UTILIZATION FACILITY LICENSE FOR THE FLAIR REACTOR TO BE CONSTRUCTED AT THE TRIGA FACILITY OF THE JOHN JAY HOPKINS LABORATORY, SAN DIEGO, CALIFORNIA. Enclosure 2, HAZARDS SUMMARY REPORT. Mar. 1, 1960. 39p.

A modified TRIGA reactor and experiments to be conducted with the reactor are described. The FLAIR Reactor (Flashing Advanced Irradiation Reactor) will use TRIGA fuel elements in the same core array as the TRIGA, but will employ a variety of reflector materials. Purpose of the experiments is to measure the effects of various reflectors on the transient and steady-state characteristics of the reactor. The reactor building, the reactor, and associated instrumentation are discussed. An analysis of the potential hazards of operations is presented. (W.D.M.)

12382 HMI-B8

Hahn-Meitner-Institut für Kernforschung, Berlin.

KONSTRUKTION UND BETRIEB EINER DESTILLATIONSAPPARATUR FÜR DIE SPALTSTOFFLÖSUNG DES "BER." (Construction and Operating of an Apparatus for Distilling the Fuel Solution of the BER.). E. Ehn and H. U. Woelk. Jan. 1960. 18p.

The design, installation, and operating experience are given of an apparatus for distilling the fuel solution of the Berlin Research Reactor (BER) of the Hahn-Meitner Institut für Kernforschung. (T.R.H.)

12383 INTERNUC-47

Internuclear Co., Inc., Clayton, Mo.

EXPERIMENTAL AND ANALYTICAL STUDIES OF REFLECTOR CONTROL FOR THE ADVANCED ENGINEERING TEST REACTOR. PART A. EXPERIMENTAL STUDIES WITH THE REFLECTOR CONTROL SYSTEM MODEL. W. S. Delicate, M. J. Kornfeld, and A. M. Larson. PART B. ANALYTICAL STUDIES OF REFLECTOR CONTROL. P. C. Bertelson and T. L. Francis. Oct. 21, 1959. 278p. Contract AT(11-1)-688. OTS.

Studies of reflector control for the Advanced Engineering Test Reactor were made. The performance of various parts of the reflector control system model such as the safety reflector and the water jet educator, boric acid injection, and demineralizer systems is discussed. The experimental methods and results obtained are discussed. Four reflector control schemes were studied. The schemes were a single-region and three-region reflector schemes, two separate reflectors, and two connected reflectors. Calculations were made of shim and safety reflector worth for a variety of parameters. Safety reflector thickness was varied from 7.75 to 0 inches, with and without boron. Boric acid concentration was varied from 100 to 2% of saturation in the shim reflectors. Neutron flux plots are presented. (C.J.G.)

12384 NAA-SR-Memo-1843

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

REACTOR COOLANT PUMPS: SODIUM FREEZE SEAL COOLING LOADS. R. W. Atz. Jan. 24, 1957. 12p. OTS.

A summary of the cooling load data for the SRE sodium coolant pump freeze seals is presented. (J.R.D.)

12385 NAA-SR-Memo-1978

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

OMRE LOW FLUX EXPERIMENTS AND APPROACH TO FULL POWER. R. P. Varnes. Oct. 21, 1957. 36p. OTS.

Experiments described as zero power tests, low power tests, and tests during the approach to full power are scheduled to provide information on OMRE behavior prior to normal power operation. Outlines of the test procedures are presented. (J.R.D.)

12386 NAA-SR-Memo-4130

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ANALYSIS OF OMRE WASTE GAS. H. M. Gilroy. Jan. 26, 1960. 23p. OTS.

A study was conducted to determine the composition, removal rate, and radioactivity of the decomposition gases from the OMRE as a function of reactor operating parameters. The resulting data are tabulated. An analysis of the data for use in design of the Pique waste gas system is included. (J.R.D.)

12387 NAA-SR-Memo-4810(Rev. A)

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THERMAL AND HYDRAULIC PRELIMINARY DESIGN METHOD FOR THE OMRE U-ALLOY (4th) CORE LOADING. D. B. Sedgley. Dec. 30, 1959. 16p. OTS.

An investigation was conducted to determine the thermal and hydraulic performance of an OMRE core with fuel elements of any type, and specifically for the prototype elements selected for the OMRE 4th core loading. A method for preliminary survey calculations of steady state thermal and hydraulic performance of the U-alloy core load was developed, equations were derived and calculations on selection of fuel element type were made. (J.R.D.)

12388 NAA-SR-Memo-4907

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SOME EFFECTS OF FUEL ELEMENT GEOMETRY UPON THE NUCLEAR, THERMAL AND HYDRAULIC PERFORMANCE OF AN OMRE CORE. R. W. Hardy, B. L. Hoffman, and D. B. Sedgley. Jan. 29, 1960. 19p. OTS.

A general performance comparison of fuel element configurations having cell dimensions compatible with the OMRE grid structure was conducted. Results show that plates and rods are almost equivalent, and both are superior to concentric rings in nuclear and thermal performance. (J.R.D.)

12389 CEA-tr-A-669

CONTRIBUTION À L'ÉTUDE DA COMPORTEMENT DE SUBSTANCES RADIOACTIVES DANS LES EAUX SUPERFICIELLES. I. COMMUNICATION SUR LES OPÉRATIONS DE CONTROLE AUPRÈS DU RÉACTEUR DE RECHERCHES DE MUNICH. (Contribution to the Study of the Behavior of Radioactive Substance in Surface Waters. I. Communication on the Control Operations of the Munich Research Reactor). M[anfred] Ruf. Translated into French from Gas-u. Wasserfach 98, 1249-51(1957). 17p.

The radioactivity of the Isar River and the Garching Canal, both of which are within the region of influence of the Munich Research Reactor, was studied. The natural radioactivity is weak, but because of prolonged tests with atomic bombs and the resulting pollution of surface waters with radioactive fall-out, the actual activity is approximately $\frac{1}{5}$ of the tolerance dose for drinking water. Extreme values, which were measured after much precipitation, exceed slightly and for a short time this tolerance dose. Because of the water contamination an increase of the radioactivity of aquatic plants and river mud was observed. No increase was found in the radioactivity of the fish. (tr-auth)

12390

APPLICATIONS OF SWIMMING POOL REACTORS. F.-J. Libert (INDATOM, Paris). Énergie nucléaire 2, 10-21 (1960) Jan.-Feb. (In French)

Swimming pool reactors are considered with respect to their applications. They are used as radiation sources in numerous experiments in pure and applied science. The available flux, higher than 10^{13} n/cm^2 sec, offers extended experimental possibilities. These are described in general and within the framework of three large areas of utilization: research, instruction, and industry. A brief examination of the effect of the experimental program on the basic conception of the swimming pool reactor infers the necessity of a preliminary selection between a reactor with and without channels. (tr-auth)

12391
THE POWER RESPONSE OF THE EBWR. J. L. de Roos. Ingenieur, (Utrecht) 71, 049-56(1959). (In Dutch)

The use of a reactor oscillator in studying reactor behavior is discussed. Some results obtained with CP-II and EBWR are given. (auth)

WASTE DISPOSAL AND PROCESSING

12392 CWLR-2307
Chemical Warfare Labs., Army Chemical Center, Md.
THE FEASIBILITY OF REDUCING THE COST OF DISPOSAL OF REACTOR WASTES BY USING FISSION PRODUCTS AS HEAT SOURCES. Luther M. Hardin and Robert P. Beckelheimer. Nov. 1959. 50p.

Predictions and calculations are presented for (1) the rate of growth of the nuclear-power industry, (2) the total fission-product power per unit reactor power, (3) the useful fission-product heat output per unit reactor power, (4) the useful heat output from all the fission products resulting from the nuclear power industry during the period 1960 to 1980. Costs involved in the production of heat are compared with the value of the heat produced. (auth)

12393 IDO-14367
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
EVALUATION OF WASTE DISPOSAL BY ELECTRODEIONIZATION AND CLAY ABSORPTION. W. H. Burgus and Earl S. Grimmett. Oct. 20, 1954. Decl. Mar. 15, 1960. 15p. Contract [AT(30-1)-205]. (CPP-54-103). OTS.

Results of an evaluation of a waste handling process consisting of electrodeionization to reduce aluminum content followed by absorption of the fission products on clay are presented. A tentative flowsheet is included. (J.R.D.)

12394 RISLEY-5073
Gt. Brit. Div. of Atomic Energy (Production), Risley, Lancs, England.
WINDSCALE WORKS EFFLUENT PIPELINES TO THE SEA. W. L. Day. June 29, 1949. 25p.

A method of laying pipelines on the sea bed for use in discharge of Windscale liquid effluent is described. Details of the procedure for extending lines two miles to sea are given including a tabular time schedule. (J.R.D.)

12395
THE INCORPORATION OF FISSION PRODUCTS INTO GLASS FOR DISPOSAL. A. R. Bancroft (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Chem. Eng. 38, 19-24(1960) Feb.

A method for the incorporation of fission products into glass is being studied at Chalk River. Glass containing up to 50 curies of fission products per kilogram has been made, and used in stability studies in the laboratory and in the field. Nepheline syenite (a rock containing Na, K, and Al silicates) fluxed with up to 30% by weight of lime, is used as the base for the glass. A nitric acid solution of the fission products is added to a pelletized mixture of the solids. When the mixture is heated nitric acid is evaporated near 110°C. The nitrates are decomposed in the temperature range 130 to 600°, and the mixture is melted to form a glass at a maximum temperature of 1350°C. Two fission products, ruthenium and cesium, are volatilized to varying degrees from the mixture during heating and create a major contamination and containment problem. The method of processing and results obtained are discussed. The volatilized elements were removed from the off-gas stream by a method which permits their incorporation into glass. Scale-up of the process to treat fission product wastes from power reactors should present no great difficulty other than design of equipment for the remote processing of large quantities of radioactive material at high temperature. (auth)

12396
RADIATION HAZARDS IN NUCLEAR ENERGY. J. Kooi. Chem. Weekblad 55, 401-7(1959). (In Dutch)

The problems arising from the production of considerable amounts of radioactive waste in the large scale application of nuclear energy are outlined. Some of the methods used or proposed for ultimate waste disposal are discussed. (Reactor Centrum Nederland).

12397
STUDY OF THE SOLIDIFICATION OF RADIOACTIVE SLUDGES. Roger Bonniaud and Pierre Cohen (Commissariat à l'Énergie Atomique, Paris). Énergie nucléaire 2, 22-6(1960) Jan.-Feb. (In French)

A study was made of simple methods of transforming humid sludges into a stable solid mass which does not exude and which, if placed in accidental contact with water, is only very slowly leached. Cementation appears to be the simplest procedure. The activity loss by immersion in water is slow and rapidly reaches a plateau. The introduction of sodium silicate to the cement composition causes an appreciable decrease in the rate of leaching by water. Encasing in sodium silicate decreases it still further. The best composition studied was Portland cement without sand. (tr-auth)

12398
THE PROBLEM OF RADIOACTIVE WASTE DISPOSAL IN THE WORLD. František Běhounek (Czech Technical Univ., Prague). Jaderná energie 6, 53-61(1960) Feb. (In Czech.)

The methods of radioactive waste disposal are reviewed relative to the hazards to man. The uptake of P^{32} by various fish and organisms found in water is discussed. (C.J.G.)

DEPOSITORIES OF USAEC REPORTS IN NON-U.S. LIBRARIES

The libraries at the organizations listed below maintain collections of unclassified U. S. Atomic Energy Commission reports for reference use.

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atómica

AUSTRALIA
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission

AUSTRIA
Vienna, Zentral Bibliothek der Physikalischen Institut der Universität
Vienna, International Atomic Energy Agency

BELGIAN CONGO
Leopoldville, Université Lovanium

BELGIUM
Brussels, Centre d'Etudes pour les Applications de l'Energie Nucléaire
Brussels, La Bibliotheque EURATOM

BRAZIL
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao

BURMA
Rangoon, Union of Burma Applied Research Institute

CANADA
Hamilton, McMaster University
Ottawa, National Research Council Library
Vancouver, University of British Columbia

CEYLON
Colombo, University of Ceylon

CHILE
Santiago, Ministerio de Relaciones Exteriores

CHINA
Hsinchu, Formosa, National Tsing Hua University Library

COLOMBIA
Bogotá, Comision de Energia Atomica de Columbia

COSTA RICA
San Pedro, University of Costa Rica Library

CUBA
Havana, Comisión de Energía Nuclear de Cuba

DENMARK
Risö, Danish Atomic Energy Commission

DOMINICAN REPUBLIC
Ciudad Trujillo, National Palace

ECUADOR
Quito, Escuela Politécnica Nacional

EGYPT
Cairo, Atomic Energy Commission

EL SALVADOR
San Salvador, Universidad Nacional, Facultad de Ingenieria

ENGLAND
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington
Manchester, Central Library
Newcastle upon Tyne, Central Library
Nottingham, Public Libraries
Sheffield, Central Library

FINLAND
Helsinki, Teknillisen Korkeakoulun Kirjasto

FRANCE
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Académie des Sciences
Paris, Organization for European Cooperation, Nuclear Energy Library

GERMANY
Berlin, Hahn-Meitner-Institut für Kernforschung Berlin
Frankfurt/Main, Gmelin-Institut
Munich, Technische Hochschule, Bibliothek

GHANA
Accra, University College of Ghana

GREECE
Athens, Greek Atomic Energy Commission

GUATEMALA
Guatemala, Comisión Nacional de Energía Nuclear

HAITI
Port au Prince, University of Haiti

HONDURAS
Tegucicalpa, Comisión Hondureña de Energía Atómica

ICELAND
Reykjavik, University of Iceland, Atomic Energy Library

INDIA
Bombay, Department of Atomic Energy

INTER-AMERICAN NUCLEAR ENERGY COMMISSION
Washington, D. C., Pan American Union

IRAN
Tehran, Tehran University Center for Nuclear Studies

IRAQ
Baghdad, Iraqi Atomic Energy Commission

IRELAND
Dublin, University College

ISRAEL
Tel Aviv, Israel Atomic Energy Commission

ITALY
Milan, Centro di Studi Nucleari di Ispra del C.N.R.N.
Rome, Comitato Nazionale per le Ricerche Nucleari

JAPAN
Tokyo, Science Section, Diet Library

KOREA
Seoul, Atomic Energy Research Institute

LEBANON
Beirut, American University

LUXEMBOURG
Luxembourg, Ministry of Transport and Electricity

MEXICO
Mexico, D.F., Comisión Nacional de Energía Nuclear

NETHERLANDS
The Hague, Reactor Centrum Nederland

NEW ZEALAND
Wellington, Department of Scientific and Industrial Research

NORTHERN IRELAND
Belfast, Department of Industrial and Forensic Science

NORWAY
Lilleström, Institutt för Atomenergi

PAKISTAN
Karachi, Atomic Energy Commission

PERU
Lima, Biblioteca Nacional

PHILIPPINE REPUBLIC
Manila, Philippine Atomic Energy Commission

POLAND
Warsaw, Biura Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej

PORTUGAL
Lisbon, Junta de Energía Nuclear

SCOTLAND
Glasgow, Mitchell Library

SPAIN
Madrid, Junta de Energía Nuclear

SWEDEN
Stockholm, Atomenergi AB

SWITZERLAND
Geneva, United Nations Library
Zurich, Institut für Physik, Eidg. Technische Hochschule

THAILAND
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science

TURKEY
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library

UNION OF SOUTH AFRICA
Pretoria, Atomic Energy Board Library, Council for Scientific and Industrial Research

UNITED NATIONS
New York, N. Y., U.N. Headquarters

URUGUAY
Montevideo, Universidad de Montevideo

VENEZUELA
Caracas, Instituto Venezolano de Investigaciones Cientificas

VIET-NAM
Saigon, Office of Atomic Energy

YUGOSLAVIA
Belgrade, Federal Nuclear Energy Commission

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

TECHNICAL PROGRESS REVIEWS

The U. S. Atomic Energy Commission, Technical Information Service, publishes an unclassified series of Technical Progress Reviews which provide concise summaries of current atomic developments. Issued quarterly, each of these Technical Progress Reviews digests and evaluates the latest findings in a specific area of nuclear technology and science. The Reviews also report on technology developed in military reactor and other classified AEC programs to the extent that the technology can be dissociated from sensitive military and production data.

The four journals published in this series are:

Nuclear Safety, W. B. Cottrell, editor, R. A. Charpie, advisory editor, and associates, Oak Ridge National Laboratory

Power Reactor Technology, Walter H. Zinn and associates, General Nuclear Engineering Corporation

Reactor Core Materials (covering solid material developments), R. W. Dayton, E. M. Simons, and associates, Battelle Memorial Institute

Reactor Fuel Processing, Stephen Lawroski and associates, Chemical Engineering Division, Argonne National Laboratory

Each journal may be purchased by subscription (domestic, $2.00 a year; foreign, $2.50 a year) or by individual issue (55¢) from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.